THURSDAY, DECEMBER 17, 1914.

THE ROYAL SOCIETY OF ARTS.

A History of the Royal Society of Arts. By Sir Henry Trueman Wood. Pp. xvii + 558. (London: John Murray, 1913.) Price 15*s.* net.

TO many who have attended meetings and lectures at the Royal Society of Arts during the last quarter of a century, or have been connected with its management, it will seem exceedingly appropriate that this history of the society since its inception in 1754 should have been written by Sir Henry Trueman Wood, its secretary since 1879, who, during all these latter years has been so intimately associated with all its activities that the society can scarcely be thought of by anyone without his well-known, tall, and spare figure appearing simultaneously to the mental eye.

To a large number of the public, and perhaps also to not a few members of the society itself, much of the information contained in this book will be something of a revelation. Few can know the early history of the society and the large amount of work that it performed during the latter half of the eighteenth century, while but a small number of its present-day members can be aware of its remarkable membership in early times. This included, among numerous and distinguished members of the peerage, a perfect medley of famous personages in various walks of life. For instance, we find among them Edward Gibbon, the historian of "The Decline and Fall"; Thomas Chippendale, of furniture fame; Benjamin Franklin, the distinguished American natural philosopher and politician; David Garrick, the actor; Oliver Goldsmith, the poet; Dr. Johnson, of dictionary fame; William Hogarth, the painter; Robert Adam, one of the two brothers who were the eminent architects who built the existing somewhat quaint and old-fashioned building in which the society still has its offices and holds its meetings; Sir Joshua Reynolds, first president of the Royal Academy; William Pitt, afterwards Earl of Chatham; and the notorious John Wilkes, to mention only a very few of those who are best known.

The society included in its membership all sorts and conditions of men, and interested itself in an extraordinary variety and multiplicity of matters. There does not seem to be much connection between mangold-wurzels, which the society appears to have introduced, harpoons, motive power, steel and gem engraving, naval construction, leadless glazes, medicinal plants, chimney sweeping or fire escapes, to mention just a few subjects taken at random from the long list that has been dealt with by the society at various times. Evidently the society, like Francis Bacon before it, took all knowledge for its province.

Especially interesting is the account of the large part played by the Society of Arts in the foundation of the great exhibitions of 1851 and 1862, and through these, as the author states, "of that long series of international exhibitions which have had such far-reaching influence on the arts, as well as on industry and trade."

Of great interest, also, is the chapter devoted to the society's medals, many of which are well illustrated, and, having been designed by Flaxman, the two Wyons, and other celebrated artists, are in themselves objects of beauty.

Some of the facts brought out as to various inventions are somewhat astonishing, as, for instance, that, until invented by Sturgeon—to whom the society granted in 1825 both a medal and a premium—the electromagnet, which to-day is so enormously employed in telegraphy and telephony and in almost every description of electrical plant, was unknown. Without this instrument practically no modern electrical development could have taken place. This is probably the most important invention that the society ever directly encouraged, for, as stated in the work under review, it is disappointing that the names of Watt, Crompton, Arkwright, and others are missing among those rewarded by the society.

The author says: "The best reason that can be suggested is that all these men were in advance of their time. Like all great inventors, they had to wait for recognition until they had overborne the opposition of ignorance and of rival interests, and it was then too late for prizes or contributions." Further, the society in its early years excluded all patented inventions from those eligible for premiums, continuing this practice up to about 1844, when wiser counsels prevailed and the rule was abandoned.

Another electrical contrivance of value, namely, the Smee galvanic battery, received in 1840 the reward of a gold medal, while in 1841 Robert Murray received a silver medal and 10*l.* for his invention of the now universally used method of obtaining a conducting surface for electro-deposition by means of plumbago. As recorded by Sir Henry Wood, however, perhaps in early days the society effected less by means of its medals and premiums than it did by its success in the starting of new movements. Allusion has already been made to its influence on the great exhibitions, but, as is pointed out by the author, the society also played a great part in regard to reform of the Patents Acts; in connection with artistic copyright; in the starting of mechanics' institutes

throughout the country; in promoting technical education; in reference to national musical training; in regard to postal reforms; in the institution of public examinations for various purposes, and numerous other subjects of public interest.

In later years the "Cantor" and other lectures by eminent scientific men on all manner of subjects have more and more become one of the chief elements of the society's well-known usefulness.

This is made evident by the author, who also gives accounts of other of the society's manifold activities in various directions, which cannot here be mentioned for want of space.

It should be added that Lord Sanderson, G.C.B., chairman of the council of the society for the years 1911–1913, contributes an illuminating preface. A. A. CAMPBELL SWINTON.

HOUSEHOLD SCIENCE.

Physics of the Household. By Prof. C. J. Lynde. Pp. xi+313. (New York. The Macmillan Co.; London: Macmillan and Co., Ltd., 1914.) Price 5*s*. 6*d*. net.

THE author of this book is professor of physics in the Macdonald College, an affiliated college of the McGill University, Montreal, where a school of household science is one of the branches of the institution, and it is for students of household science that the book is written. It presents the subject of physics in close relation to its domestic applications, and abounds in illustrations and examples of household appliances and processes. It should be of great use to science teachers, especially those who have to teach girls, in reminding them of the range of familiar things and topics of physical interest that lie in the home environment, and that often lie unheeded and unexplained.

The suitability of the book for students themselves is, perhaps, more open to discussion, and it is more than likely that it will come under the censure of teachers who are wedded to the conventional form of text-book. The chief ground of attack would no doubt be that so far as the general principles of physical science are concerned, the elucidation is cramped and obscured by the weight of illustrations of their practical application. To treat the subjects of mechanics, heat, electricity and magnetism, light and sound and their applications in three hundred pages has led to a certain breathlessness of style, and some topics are treated very vaguely.

The gaps in the knowledge of those in control of the household that are the most conspicuous and seem to call most loudly for repair, do not relate so much to the design and principles of construction of appliances, as to the conduct of operations. An increased apprehension of the application of the lever principle or of the construction and *modus operandi* of an electric bell is all to the good, but it is not to be compared with a real live knowledge of the laws of heat and the capability of thinking and acting within them in the great field of household operations to which they apply. It is extraordinary to see the woodenness with which a woman armed with the conventional "heat" of the school or college text-book will face simple problems of heating or cooling as they arise in the household. This defect is not to be repaired merely by a rational account of the principles on which heating appliances are constructed. To instil real activity of mind it is necessary to teach in terms of problems with a wide range of experimental exercises.

For the reasons indicated above, it is fair to say that the value of Prof. Lynde's book to students must depend very largely on the laboratory work that accompanies it, and on the constant raising of questions and corollaries by the teacher. This, however, is true of most text-books, and it must not lead us to undervalue one that has so large an element of originality and is so likely to be useful. A. S.

HOG-SPEARS AND FISHING-RODS.

(1) *Modern Pig-Sticking.* By Major A. E. Wardrop. Pp. xii+304. (London: Macmillan and Co., Ltd., 1914.) Price 10*s*. net.

(2) *Fishing and Philandering.* By A. Mainwaring. Pp. 254. (London: Heath, Granton and Ouseley, Ltd., n.d.) Price 6*s*. net.

(1) WHAT fox-hunting is to England, pig-sticking is to India, with the difference that the latter has that spice of personal danger from attacks on the part of the quarry which, to the regret of many sportsmen, is entirely lacking in the former. Both, too, have nowadays this in common, namely, that in their headquarters they depend to a greater or less degree on protection for their quarry—a fact which may come as a surprise to those unacquainted with India at the present day, and the great diminution in the numbers of its big game which has taken place in many districts. The headquarters of pig-sticking are the "khadirs," or river-valleys, of the Ganges and Jumna in the respective districts of Meerut and Muttra; and to old Anglo-Indians who have ridden or shot in the khadir, Major Wardrop's gossipy book will come as a delightful reminiscence of bygone days. To the newcomer in India it will serve as an incentive to rival the deeds of his predecessors in one of the most noble and exciting of all field-sports.

How well qualified is the author (aided by contributions from other hog-hunters) for his task may be inferred from the statement that he has been present, to the best of his belief, at the death of between seven hundred and eight hundred boars. To stay-at-home people such numbers may savour somewhat of exaggeration, but any such misgivings may be dispelled by reference to the final chapter of the book, where he will learn that the average annual bag of the Muttra tent-club alone is 210 head.

Major Wardrop gives his readers a glimpse of early pig-sticking by recalling the almost forgotten fact that for the first quarter of last century the universal weapon was the long throwing spear, and that the modern short "jobbing" spear did not come into use until 1830. In the penultimate chapter he discusses the paraphernalia and technique of the sport. For the contents of the intermediate chapters the reader must be referred to the book itself, which he will probably not leave until he has read it from cover to cover.

(2) An equally delightful volume is the second on our list, although it has to be confessed that its contents include more "philandering" than "fishing"; but since it teems with anecdotes which can scarcely fail to raise a hearty laugh, its appearance in these troublous times should be very welcome. Like the first, this volume will prove of interest to Anglo-Indians, as it contains a chapter of mahsir-fishing, coupled with the author's experiences among what he is pleased to denominate Indian trout. As regards the remainder of the book, perhaps the most valuable chapter to the practical angler is that dealing with the use of shrimps as a bait, as practised in Ireland, a considerable portion of which originally appeared in the *Field*. Like most anglers who have tried their hands on fish of many kinds, Mr. Mainwaring unhesitatingly awards the palm, from the point of view of sport, to the lordly salmon, although he confesses to be no adherent to the "dry fly" mode of catching his fish. The general scope of the volume is well indicated by its title, and the author does not even touch upon the natural history side of the subject. R. L.

MATHEMATICAL TEXT-BOOKS.

(1) *Elements of Algebra.* By G. St. L. Carson and Prof. D. E. Smith. Part i., pp. v+346. (London and Boston: Ginn and Co., 1914.) Price 3*s*.

(2) *John Napier and the Invention of Logarithms, 1614.* A lecture by Prof. E. W. Hobson. Pp. 48. (Cambridge University Press, 1914.) Price 1*s*. 6*d*. net.

(3) *An Elementary Treatise on the Calculus for Engineering Students.* With numerous examples and problems worked out. By J. Graham. Fourth Edition. Pp. xi+355. (London: E. and F. N. Spon, Ltd., 1914.) Price 5*s*. net.

(4) *Constructive Text-book of Practical Mathematics.* By H. W. Marsh. Vol. iv.: Technical Trigonometry. Pp. x+232. (New York: J. Wiley and Sons. Inc.; London: Chapman and Hall, Ltd., 1914.) Price 6*s*. 6*d*. net.

(5) *Arithmetische Selbstständigkeit der europäischen Kultur.* Ein Beitrag zur Kulturgeschichte von Prof. N. Bubnow. Aus dem Russischen übersetzt von Prof. J. Lezius. Pp. viii+285. (Berlin: R. Friedländer und Sohn 1914.) Price 10*s*.

(1) THE teaching of algebra is still in the experimental stage, and is likely so to remain for many years to come. There are extremists in each camp. There are those who feel that no real progress can be made until considerable manipulative skill has been acquired, and those who hold that the real educational value consists in the absorption of certain general ideas which are largely independent of algebraic drill. The authors of this volume claim to steer a middle course. How far they have succeeded in solving the puzzling problem with which educationists are faced to-day can only be decided by trial. Certainly there are many good features in their book, which is based on the formula rather than the problem. But until an actual trial is made of their methods, it is impossible to pronounce with any certainty on the merits of their scheme, for the ramifications, affecting as they do the whole scheme of education of the non-specialist, are particularly intricate. We shall look forward with interest to the second volume.

(2) In view of the tercentenary celebration of the publication of John Napier's "Mirifici Logarithmorum Canonis Descriptio," under the auspices of the Royal Society of Edinburgh, the issue of this small volume comes at an opportune moment. Most schoolboys have heard of logarithms and realise their practical utility; but few of them are acquainted with their history, and fewer still with the form in which they originated. Dr. Hobson gives in a simple and very readable manner a comprehensive account of their discovery and evolution; an engraving of Napier and a reproduction in facsimile of a page of the Descriptio add to the attraction of a book that should find its way into every school library.

(3) The opening chapters of this text-book contain in outline such parts of algebra, trigono-

metry, and co-ordinate geometry as are requisite for a study of the calculus. Differentiation and integration are taken separately, on ordinary lines. Applications are then made to Fourier series, moments of inertia, pressure, electricity, etc., and the concluding chapters deal mainly with differential equations and their use in physics. There is not any particular note of originality, but the treatment is good, and should enable engineering students to acquire a satisfactory acquaintance with infinitesimal methods.

(4) The aim of this text-book is to bring the subject of trigonometry into as intimate a relation as possible with those problems of modern life which are most likely to interest the ordinary student. The author believes that too much importance is attached to surveying and ship-problems and too little to technical industries. Consequently many of the questions, and a number of excellent diagrams, deal with different forms of machinery and scientific instruments.

(5) This is a German translation of a Russian treatise. It is intended to form one of a series of investigations into the early development of mathematics in Europe. The present volume deals mainly with the evolution, structure, and use of the abacus. The author has made a careful study of the writings of Gerbert, and has attempted to remove some of the many obscurities they contain. Two other volumes are promised, one dealing with the history and origin of our figures, and the other with the history of Euclidean geometry in Latin civilisation.

BY-WAYS OF MEDICINE.

(1) *The Ileo-Caecal Valve.* By Dr. A. H. Rutherford. Pp. vi+63. (London: H. K. Lewis, 1914.) Price 6*s.* net.

(2) *I.K. Therapy: with Special Reference to* Tuberculosis. By Dr. W. E. M. Armstrong. Pp. x+83. (London: H. K. Lewis, 1914.) Price 5*s.* net.

(3) *Clinical Examination of the Blood and its Technique: a Manual for Students and Practitioners.* By Prof. A. Pappenheim. Translated and adapted from the German by R. Donaldson. Pp. viii+87. (Bristol: J. Wright and Sons, Ltd., 1914.) Price 3*s.* 6*d.* net.

(1) THE contents of this book constituted a thesis for the M.D. degree submitted to the University of Edinburgh. The term ileo-cæcal valve is applied to the orifice between the small and large intestines and the anatomical structures immediately adjacent and intimately concerned with this orifice. The author shows that divergent views have been expressed regarding the form and structure of this valve, divergences due partly to the method of preparation of the specimens and partly to variations in the valve itself. From an examination of a living subject, and from a series of thirty-two specimens removed soon after death and suitably treated, the author believes that he is able to describe the normal appearance of the valve, the function of which is to regulate the flow of semi-fluid bowel contents through the orifice and to prevent regurgitation. The book is illustrated with coloured diagrams and a number of excellent half-tone plates.

(2) "I.K." therapy has been evolved as the result of many years' labour by Carl Spengler, of Davos. It is chiefly directed against tuberculosis, but is being extended to other bacterial infections. The exact details of the preparation of the remedy have not been published, but the principle employed is the immunisation of a rabbit by means of intra-muscular injections of tubercle virus. The animal is then bled and the *whole* blood (not the serum only) is taken, laked, and high dilutions are prepared, it may be up to one hundred million. Spengler maintains that the red-corpuscles are carriers of the immune substances to a degree far exceeding that of the serum. These immune bodies ("Immunkörper," hence the title "I.K.") are the active therapeutic constituents. They possess partly lytic or solvent action on the tubercle bacillus and partly antitoxic or antidotal action against the tuberculous toxins.

The author describes in detail the above considerations and discusses the treatment of tuberculosis with I.K. serum. As regards the results obtained with it, the statistics are few and incomplete, though those who have employed it claim that cure of pulmonary consumption may be anticipated in all but the most advanced cases. Unfortunately, in estimating the gravity of a case of pulmonary consumption, it is impossible to allow for the extraordinary spontaneous improvement and recovery which sometimes occur in these patients, and more or less selection, in some instances unconscious, is practised by the physician, so that we believe that the only true test of *any* form of treatment lies in treating alternate cases only of a long series—a mode of trial which has yet to be applied to tuberculin and all other forms of treatment.

Dr. Armstrong has given a very useful summary for those who may desire to apply I.K. treatment, and has also included details of some beautiful staining methods for the tubercle bacillus and of the precipitin reaction for the diagnosis of tuberculosis which have likewise been devised by Dr. Carl Spengler.

(3) This little book, while forming a useful guide to the clinical examination of the blood, contains little that cannot be found in several well-known manuals on this subject. The only novelty, in fact, which we notice in it is the particular technique employed by Prof. Pappenheim. In some respects, indeed, it is lacking. Thus we find no mention of a common method of enumerating the leucocytes by an examination of microscopic fields in the preparation employed for a red-cell count, and there is no connected account of the blood-picture of pernicious anæmia and of the leukæmias. The nomenclature of the blood-cells and their variations is also unusual and difficult to follow by those accustomed to British nomenclature. In some respects the book is interesting reading, *e.g.* Prof. Pappenheim's views on the derivation of the leucocytic cells. The book contains two beautiful coloured plates of the blood-cells and numerous figures in the text.

R. T. HEWLETT.

OUR BOOKSHELF.

The Annual of the British School at Athens. No. xix. Session 1912–1913. Pp. viii+314. (London: Macmillan and Co., Ltd., 1914.) Price 25*s.* net.

THE most valuable contribution to this issue of the annual is the report by Messrs. R. M. Dawkins and M. L. W. Laistner on the famous Kamares Cave in Crete. This has been known for more than twenty years as a prehistoric sanctuary, but its complete investigation was carried out only in 1913 under the auspices of the British School at Athens. The early fame of the cave was due to the discovery in the early 'nineties of a number of vases and a few figurines. The work has now been successfully accomplished under considerable difficulties. The general result is that the votive objects which form so striking a feature of other caves and mountain sanctuaries in Crete —the libation tables of Psychro, the shields and bronzes of the Idæan cave, and the figurines of Petsofá—are conspicuously absent. The question then arises whether the Kamares Cave was really a sanctuary or only a shelter. The writers conclude that its position renders its use as a shelter improbable; the finds themselves, if they do not positively suggest a sanctuary, equally negative the idea of a dwelling, because houses of the Bronze Age in Crete invariably yield obsidian, while not a single flake was found in this cave. The pottery, again, does not suggest domestic uses. On the other hand, the restricted range of the pottery shapes suggests a sanctuary in which votive vessels were deposited. The cave, in short, was probably a sanctuary of the tutelary divinity of the mountain.

Another side of the subject is illustrated by a report in the same issue of the Journal by Dr. J. Hazzidakis, of an early Minoan sacred cave at Arkalokhori. Here some interesting vases were unearthed with remarkable bronze swords or daggers. Double axes, undoubtedly symbols of the deity worshipped by the Cretans in the prehistoric period, lead to the conclusion that during the whole of the long period of the Bronze Age, the Minoan periods of Sir A. Evans, the Cretans practised one and the same cult, and this is as much as to say that they were, all through, one and the same people.

The Fauna of British India, including Ceylon and Burma. Edited by Dr. A. E. Shipley, assisted by G. A. K. Marshall. Orthoptera (Acridiidæ). By W. F. Kirby. Pp. ix+276. (London: Taylor and Francis, 1914.) Price 10*s.*

THE lamented death of Mr. W. F. Kirby left his memoir on the locusts of British India not quite completed. So far as completion was possible it has been effected by the kind offices of Mr. C. O. Waterhouse, who has compiled many of the diagnostic keys. The memoir, which is an admirable piece of systematic work, deals with no fewer than 329 species of Acridiidæ.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Wet Bulb Temperature and Climatology.

IT is rather disappointing to find, according to your report of the proceedings of the Section of Physiology of the British Association, the discussion upon climate had to be abandoned because no one was prepared to follow up Prof. Osborne's contribution to it. For the points raised by Prof. Osborne, according to what we gather from your short report (p. 322), are of great and vital interest. He emphasises the importance of the readings of the wet-bulb thermometer as indications of what one might call the evaporative quality of the atmosphere as it affects the economy of the human body. Unfortunately the wet-bulb thermometer is untrustworthy for several reasons, and it is well known that physicists treat it with scant respect. Its indications depend in an uncertain way on the physical condition of the air surrounding it, and no one has been able to give a satisfactory method of deducing from its readings the value of the vapour pressure of the atmosphere. Recent experiments of ours with the Kata thermometer prove beyond question that the rate of evaporation from the skin depends directly on the defect of the actual vapour pressure in the surrounding air from the vapour pressure in contact with the skin, and the value of the air vapour pressure can be determined very easily by means of a couple of readings of the dry and wet Kata thermometer.

In order to investigate fully the relation between the climatological condition obtaining in different parts of the United Kingdom and the cooling and evaporative power of the air as measured by the Kata thermometer, we would welcome the help of

volunteers in town and country districts, who would take daily readings with the Kata thermometer, according to directions accompanying each instrument, which we would supply. The time for taking an observation need not be more than five or six minutes. Full details of the Kata thermometer, its construction and use appear in Dr. Hill's Report of Ventilation recently published by the Local Government Board. If any of your readers are interested enough in the matter to take these readings we should be glad if they would communicate with us.

LEONARD HILL.
MARTIN FLACK.
O. W. GRIFFITH.

London Hospital Medical College,
London, E.
December 7.

Forests and Floods.

IN the issue of July 16 NATURE published a letter on the above subject in which I showed that pulverised soil holds more of the rainfall than the same soil after it is consolidated by time and rainfall, and it was pointed out that trees by the growth of their roots prevented the consolidation of the soil, and so enabled forest lands to retain more of the rainfall than undisturbed ground.

In that letter it was mentioned water passed more quickly through consolidated soil than through the same soil after it is pulverised. I have recently had an opportunity of observing how this peculiarity of dry soil acts in its disposal of the rainfall. In this district we had a very dry autumn; there was only 0·43 of an inch of rainfall in the 37 days extending from September 18 to October 24. The soil in the part of the garden to be referred to is of a light and sandy nature, and became very dry, though the plants seemed to get enough moisture for their requirements. The soil at the surface and to a depth of at least one foot seemed to be very dry. Before the end of the drought there were some cold nights, and the surface began to look more moist; this would probably be caused by the condensation of the rising vapour in the cold surface soil. When the rain began on October 25 the surface was thus in a good condition for absorbing it, and as the rainfall was never at any time heavy, and was well distributed over the eight days, during which 1·5 inches fell, none of it would run off the surface, as even during very rapid rainfalls the water easily enters that light soil. A day or two after the rain had ceased I was putting in some bulbs in the border, and was much surprised to find that below a depth of a little more than 3 inches of damp soil all underneath was as dry as it was before the rain began; while I find from tests made with soil lifted from the border, dried and broken up, that 1·5 inches of water wetted it to a depth of 6 inches. It was shown in the previous letter that pulverised soil holds a good deal more water than thoroughly wetted consolidated soil, so that the border was only moistened by the rainfall to one half the depth it would have been if all the rainfall had been retained by the upper layer of soil. The water evidently had not gone uniformly through the soil, but had made drainage tubes at certain places through which it had passed underground, leaving parts of the soil dry. This we might expect to happen if the soil was not easily wetted, or there were certain parts where the soil was more prepared to take water than at others. Such parts we might suppose to be those up which the water vapour rose most freely, and would therefore be damper, or the water may have escaped down the outsides of the roots of the plants. Now in well stirred soil there are none of these preferential routes for the escape of the water.

In illustration of these preferential routes one might point to the condition of the soil on vertical cuttings which one sometimes sees where roads are cut through banks, or on any deep cutting made in soil. It will be noticed that these cuttings have no vegetation on them, and that the soil gradually weathers away, leaving an overhanging turf. It will be noticed that the soil on the face of the bank under the turf remains dry, all the summer at least, however heavy the rainfall. The water evidently does not percolate straight to the soil underneath, but takes a preferential route, backwards from the turf, and downwards behind the dry soil. The dry soil seems to reject the water, which prefers to pass through the damp soil behind it. It was noticed at the end of November this year that these banks were still dry though 6·4 inches of rain had fallen since October 25.

Some soils seem to have very little affinity for water, and act very much in the same manner as most substances do towards mercury. For instance, when one watches the seashore on a calm sunny day while the tide is rising one often sees all kinds of dry particles which are much heavier than water floating on the surface; these particles may be sand or other earthy matter. Again, when walking over bare sandy soil one sometimes sees a curious illustration of this objection of dry sand to being wetted. If the weather has previously been very drying and there comes a shower of rain, some of the little hollows in the sand will get full of water, and retaining it as well as if they were made of puddle clay. Of course these cups are very shallow, otherwise the hydrostatic pressure would be sufficient to break the water film between the grains of sand.

However, repulsion of the water by ordinary soils does not seem to explain the passage of the rainfall through the soil without wetting it equally. A small clod of soil from the border referred to was dried, after which it was placed in a shallow vessel in which was less than 1 mm. of water. The clod quickly absorbed the water, raising it to its top surface, which was fully 1 cm. above the level of the water.

It is difficult to explain this preference of the water for certain parts of the soil, where the soil wets so easily on contact with it. Is it possible that the water by sinking a little deeper at certain places comes to exert a kind of negative hydrostatic pressure, and so draw the water from the surrounding area? This, if once started, would have a gradually increasing influence owing to the increasing "head."

The border referred to was opened up at a number of places on November 23, after nearly 4 inches of rain had fallen, and even then there were parts of the soil quite dry a few inches below the surface. It is evident that something is still required to explain these preferential routes of the water in dry consolidated soil. There are none of them in pulverised soil, and this points to the probable advantage in "dry farming" of stirring the soil to a sufficient depth to retain the whole of the rainfall, in addition to the usual practice of stirring the surface soil after rainfall to form a mulch to check its loss by evaporation.

JOHN AITKEN.

Ardenlea, Falkirk, December 5.

On an Apparently Distinctive Character of the Genus Bufo.

ON p. 38 of Mr. G. A. Boulenger's valuable work on the "Tailless Batrachia of Europe" it is stated of the vertebral column of the Anura that "In those forms in which the vertebræ are procœlous the eighth

is biconcave; the ninth being invariably biconvex." The same statement appears in the "Amphibia and Reptile" volume of the Cambridge Natural History, published some four years later (1901).

So far as I am aware, exception has never been taken to this statement. When, therefore, last year, I had occasion to examine the vertebral column of an Indian toad, *Bufo melanostictus*, I was surprised to find that the eighth and ninth vertebræ were not as described, but that, on the contrary, both were procœlous, resembling in this the seven preceding vertebræ.

At first I supposed that this was merely an abnormality resembling the condition found by Lloyd Morgan in *Rana temporaria* in 1886, and recorded by him in these columns (vol. xxxv., p. 53). I examined, however, five other specimens of *B. melanostictus* and also two of *B. andersonii*, and discovered that, in every case, all the vertebræ were procœlous, exactly as in my first specimen.

I could only come to the conclusion that, in these two species at least, we had exceptions to the rule laid down in the works quoted. On my return to England, therefore, I took an early opportunity of consulting Mr. Boulenger upon this point, who very kindly permitted me to examine a large collection of skeletons of Bufo.

Including my own specimens, more than fifty vertebral columns were examined, these belonging to some forty different species of Bufo, and it then became apparent that what I had been disposed to regard as an exceptional state of affairs, obtaining in a couple of Indian toads, *was actually an invariable condition, and, moreover, one apparently diagnostic of the genus Bufo*, for not a single specimen showed either an amphicœlous eighth or a biconvex ninth vertebra. In every case the centrum of the ninth vertebra, although hollow in front, has, of course, the usual double convexity behind.

GEO. E. NICHOLLS.
Zoological Department, King's College,
London, W.C.

A Lunar Halo.

A REMARKABLE coloured halo forming a complete circle about the moon was witnessed by me on Wednesday evening, December 2, at 7.15, my position being in North Shields. I am seventy-nine years of age, and never saw anything similar—that is, encircling the moon. It only lasted about seven or eight minutes. I am wondering if anyone else took much notice of it.

An entire ring and colours were distinctly visible. The inner part—that is, to the commencement of the halo or rain-circle—had a remarkably globular appearance, with the moon as an apex, and was the most prominent part of the phenomenon.

The moon at the time was very bright, but shining through light fleecy clouds at a great height; then the yellowy appearance commenced as shown, terminating with a dark orange rim.

The altitude of the moon would be about 60°, direction S.E., wind W.

THOS. TODD.
26 Percy Square, Tynemouth, December 5.

COLLOIDAL CHEMISTRY IN RELATION TO INDUSTRIES.

I.

WHEN the development of some branch of science reaches the stage at which a separate literature with its own terminology begins to grow up, the question of its practical utility or its value to the arts begins to be asked. Whether research has to justify itself by such directly or indirectly useful results is at least arguable, but it must be admitted that the question is particularly natural when raised in connection with a discipline like colloidal chemistry which is concerned, *inter alia*, with substances such as form the raw materials or the products of important arts, many of which, like ceramics, dyeing, tanning, the making of bread and of fermented liquors, are as old as history.

Where industries have empirically reached a high degree of perfection, the chief function of science is to provide the explanation of processes which are the outcome of experience, generally with the result that improvements become possible which experience alone cannot suggest. In judging a new branch of chemistry it is too often overlooked that even inorganic chemistry has largely played this part and has not yet quite succeeded in it in some respects: thus the theory of a process as important and familiar as the lead chamber process of making sulphuric acid is still highly controversial. On the other hand, organic chemistry provides many instances of the opposite way in which science may assist industry: by producing new bodies the properties of which are anticipated on theoretical grounds.

While, therefore, too much must not be expected of a science as young as colloidal chemistry, there is no doubt that it is destined to be of considerable value to a great number of industries in both the directions indicated above. Probably the most convenient method of showing this will be to state, without undue technicalities, a number of fundamental propositions which have now been firmly established and to illustrate their bearing on industrial processes and problems.

There is an immense amount of material to prove that the physical properties of a body may be varied continuously between wide limits by simply altering the size of its particles present or—as it is technically called, "dispersed"—in another medium, below a certain maximum limit. This is strikingly the case with the most obvious property, colour: thus, colloidal gold can be obtained red, purple, blue, or green in solutions containing the same amount of metal, and silver solutions of the same concentration may range from colourless through yellow, red, and purple to blue. Colourless or slightly coloured substances, *e.g.* sulphur, may form brilliant blue solutions. Solid colloidal solutions are also known to exist, examples of which are ruby glass, coloured by gold or copper, and the blue rock salt occurring at Stassfurt, which is coloured by metallic sodium.

The possibility of obtaining colour by dispersing a colourless substance in a colourless medium has been suggested as an explanation of the striking tint of a very puzzling class of bodies, the artificial ultramarines. Their chemical composition is very uncertain, but none of the compounds of which they are a mixture are at all likely to be

blue. Moreover, the ingredients used can, on one hand, be varied considerably without affecting the colour, and, on the other, batches of exactly the same composition may vary in colour from the desired blue to a greenish-white owing to variations in the process of fusion. The suggestion has been made, and supported by a good deal of evidence, that these variations may be due simply to differences in the "degree of dispersity," *i.e.*, in the size of the particles of one constituent disseminated through another. The same explanation has been tentatively put forward by Wo. Ostwald to account for the peculiarities of a very interesting group of dyes, the sulphide dyes—peculiarities which are not easily accounted for by their constitution alone.

It is, of course, well known that certain inorganic pigments, obtained by precipitation, vary in colour according to the concentrations and temperatures of the reacting solutions: thus, cadmium sulphide may be any shade from salmon pink to golden yellow. The reason is again to be found in the different size of the particles of precipitate which—up to certain limits—tends to increase with decreasing concentrations. There is a possibility of still further reducing this size with resulting changes in tint and incidentally with an increase in covering power, by adding to the solutions extremely small amounts of some organic colloids like glue or casein—a procedure which deserves extensive investigation by those interested.

Among the most important and most exhaustively investigated properties of colloids are their electrical characteristics. To describe these as briefly as possible, we may say that finely divided substances in contact with water and a few other liquids become electrically charged. In the majority of cases the charge is negative, but the oxides and hydroxides of a number of metals and a few dyestuffs are positive. The amount and eventually the sign of these charges can be modified by the addition of acid or alkali: thus, negatively charged particles become more so in alkaline media, while acid in increasing amounts diminishes and finally neutralises negative charges. Both these effects find technical application: thus, very fine precipitates or slimes which obstinately refuse to settle in neutral or alkaline liquids come down rapidly if the latter are made acid. The effect of acidity is to neutralise the negative charges on the particles, and their mutual electric repulsion, which helps largely to keep them in suspension. On the other hand, the addition of alkali to clay slip (the particles of which are also negative) has the opposite effect of suspending or "dispersing" the particles, so that the slip loses its plasticity and can be cast in moulds, a procedure which is employed on a large scale.

Owing to the charge on particles in contact with a liquid—which, as need scarcely be said, assumes the opposite charge—a relative movement of the two phases takes place in an electric field, that is, when electrodes connected to a source of current are immersed in the liquid. If the particles are freely suspended, they move towards the electrode having the opposite sign; if, as is sometimes the case, the solid is aggregated into a porous diaphragm, the liquid flows through the diaphragm towards the other pole. To take a concrete example: particles of carbon are negative and therefore travel towards the positive pole or anode; if they are formed into a fixed diaphragm, for instance, a plate of porous carbon, the water—which is positively charged—flows through this diaphragm to the negative pole or kathode. The movement of particles in the electric field is called cataphoresis; the flow of liquid through a diaphragm electro-osmosis. Both phenomena have been applied industrially by Count Schwerin. Thus, clays can be freed from iron oxide by being suspended in water in an electric field, since clay particles are negative while iron oxide is positive, so that the two substances travel to opposite electrodes. Spongy substances having a cellular structure, like peat, can be freed from water by being placed between a perforated plate acting as kathode while a second plate resting on the peat serves as anode. The solid being negative, the water is positive and flows to the kathode, escaping through the perforations in the latter. Both processes are capable of varied and extensive applications, many of which are being developed.

It is highly probable that electric factors play a considerable, although by no means clear, part in the various processes for separating sulphide ores from gangue with the aid of oil, particularly in the Minerals Separation process, which consists in adding to a slightly acid pulp made from the ore, part of which must be exceedingly fine, a minute quantity of oil and agitating in such a manner that a considerable quantity of air becomes mixed with the liquid. As soon as agitation ceases the air rises in the form of bubbles which carry the sulphide to the top, while the gangue sinks to the bottom. The necessity for acid reaction, in conjunction with known differences in the electrical properties of oil, quartz and air surfaces in contact with acid water, is strong evidence that the electrical properties of suspended particles play an essential part in the process, and its future investigation will have to take them into account to a much greater extent than has been the case up to the present.

Our knowledge of the effects of the two factors discussed so far—size and electric state of particles—has been gained through the study of colloidal solutions, chiefly of metals and sulphides, *i.e.*, of suspensions in which the diameter of the particles lies below the limit of microscopic visibility, roughly speaking, below 200 $\mu\mu$ (1 $\mu\mu$ = one-millionth millimetre). While the preparation of such solutions is of the greatest theoretical interest, and some are used therapeutically, they have found only a few technical applications worth mentioning.

E. HATSCHEK.

"FIELD-WORK" WITH THE BRITISH ASSOCIATION IN AUSTRALIA.

IN connection with the recent visit of the British Association to Australia, in addition to presidential addresses and evening discourses and the more formal sectional proceedings, all of which have now been fully recorded in NATURE, much good scientific work, especially in connection with the natural history sciences, was carried out by means of special meetings, expeditions, and discussions of a more or less informal character, kindly and wisely arranged by the local men of science for particular groups of the over-seas party. Moreover, on the visits paid to university laboratories, museums, and other institutions by many of the party, problems for investigation were pointed out, and plans for future research and co-operation were suggested, of value to hosts and guests alike; and it is not improbable that some of these informal conferences may have as great an effect upon the advancement of science in Australia as any of the more public meetings of the Association.

It is impossible to enumerate all the opportunities for useful work thus given to the visiting men of science, but a few of the leading occasions that were made by the Australian naturalists for bringing biologists and geologists into direct contact with the problems of wild nature may be here briefly indicated. Some of these informal expeditions and discussions, it may be added, led to the appointment of Australian research committees, to which grants were given by the British Association Committee of Recommendations meeting at Sydney on August 25.

The week or more spent by members of the "Advance Party" in Western Australia was almost wholly devoted to work in the field, both on land and water, and Prof. Dakin, one of the local secretaries and leader of the zoological excursions to the Yallingup Caves and Mundaring Weir and a dredging expedition on the Swan River, has already given some account of this field-work in NATURE for September 24. But in addition to these larger parties, groups of zoologists and others were taken on occasions to visit points of interest on the Darling Range and elsewhere, where Peripatus (*Peripatoides gilesii*, Spencer) and other rare and interesting organisms were to be found. Of scarcely less interest to zoologists and anthropologists were the discussions which resulted from visits to the collections at the Perth Museum under the direction of Mr. B. H. Woodward and Mr. Alexander, and to those at the University made by Prof. Dakin on his recent visit to the Abrolhos Archipelago (the subject of a communication to Section D at Sydney). Throughout the visit to Western Australia, although no formal sectional meetings were held, the conferences with local men of science at the University, the Museum, and in the field, dealt largely with questions of local research, and may confidently be expected to result in further investigations.

During the time of the Adelaide meeting a party of geologists and chemists visited the celebrated Broken Hill mines and the smelting works at Port Pirie for the purpose of studying the occurrence of the ores and the methods employed in working and smelting. Another party of geologists, led by Mr. W. Howchin, the discoverer of the local evidences of glaciation, at the same time visited the Sturt River to examine the Cambrian glacial beds, and also explored the Permo-Carboniferous glacial beds and the Archæocyathine lime-stones of Hallett's Cove, and finally the granitic rocks of the southern sea-coast in the neighbourhood of Victor Harbour. Several small bands of zoologists made observing and collecting trips from Adelaide to Lake Alexandrina, Victor Harbour on the coast, the Mount Lofty Range, and elsewhere, at all of which localities objects of interest were seen and material collected which may lead to research in the future.

One of the most interesting excursions from

FIG. 1.—Black swan on nest in a river of S. Australia.

Adelaide was that arranged for the anthropologists, by Prof. Stirling, to Milang, on Lake Alexandrina, for the purpose of inspecting a number of men, women, and children from the Mission Station, including some full-blooded aborigines. These gave displays of dancing, boomerang-throwing, hut-building, and basket-making, and some of the British Association party collected information in regard to cat's-cradle games and native genealogies.

Interesting botanical excursions were arranged from Adelaide by Prof. T. G. B. Osborn, one to study the Salicornia scrub and the mangrove swamps of the coastal region, one to various localities on the Mount Lofty Range to see the fern gullies and the scrub of the higher regions, and a third to Mannum, on the Murray River—all of ecological interest.

At Melbourne the time and attention of over-seas members were naturally more fully taken up

with the formal programme of sectional meetings and addresses in the city, but during the week-end various opportunities were made for exploring the natural history of the neighbourhood. The geologists were taken to Macedon to examine the alkaline igneous rocks, and to Bacchus Marsh for the Permo-Carboniferous glacial tills lying upon striated surfaces of still older rocks. Other groups of geologists were taken to Ballarat and to Bendigo. Parties of zoologists and botanists under the guidance of Prof. Ewart and others, were taken through fine scenery to various points of interest, such as Marysville, Emerald, the National Park at Wilson's Promontory, Warburton and Cement Creek, to see the celebrated big-tree country and the tree-fern gullies. But here, again, it must be remarked that a large number of smaller trips were made by experts for special purposes under private guidance, resulting in consultations between the local scientific men and their European guests.

From Sydney there were excursions of very general scientific interest to the Blue Mountains, which afforded the geologists the opportunity of studying the leading features of the geological structure of New South Wales and of the remarkable elevation, which this, in common with many other parts of the continent, experienced in Tertiary or Post-Tertiary times. These excursions were also extended to the Jenolan Caves, which are typical, but very magnificent, examples of stalactitic caves in limestone of Silurian age. Amongst other interesting features were seen the remains of an aboriginal skeleton in one cave and of a wallaby's bones in another embedded in the stalagmitic floor. Other geological excursions to West Maitland and Newcastle gave an opportunity of examining the productive coal measures of the colony. The Blue Mountains and Jenolan expeditions were, however, of interest also to zoologists and botanists, who were enabled to study in their native haunts such rare and interesting forms as Peripatus and land Planarians, and to see many of the characteristic birds and insects of the country. Other excursions from Sydney were naturally rather of a marine biological character. Prof. Haswell and Dr. S. J. Johnston organised a collecting party, which visited various parts of Port Jackson in a steam launch in order to explore the wonderfully rich invertebrate fauna exposed at low tide. Another opportunity was given by Prof. Haswell to a small party of zoologists to collect choice material from one of the islands in the harbour.

In connection with the marine fauna the question of more fully exploring the Australian fisheries was under consideration at several centres, and it seems probable that a more thorough investigation of the coastal waters and their contained plankton by modern oceanographical methods will be undertaken at an early date. Another outcome of informal conversations was the resolution, brought before the Committee of Recommendations for adoption by the Council of the Association, welcoming the project to convert a portion of Kangaroo Island in Southern Australia into a Government reserve for the protection of the fast-disappearing native land fauna.

From Sydney a number of smaller informal excursions were arranged by Prof. Lawson for the purpose of studying the botany of the Port Jackson neighbourhood, including the National Park. Another important botanical excursion, under the guidance of Mr. J. H. Maiden, visited the Bulli Pass and the Burrinjuck Dam, passing through interesting country and a rich fern vegetation.

Queensland, like Western and South Australia, was felt to be a centre for work in the field rather than for sectional meetings and discussions. The expeditions from Brisbane included the gold and copper mines of Mount Morgan and the Gympie gold field, and, also for geologists, those to the Glass-house Mountains, a series of Trachytic volcanic necks rising abruptly from the plain (see Fig. 3), and to Ipswich to examine the Trias-Jura coal measures and associated volcanic rocks. Zoologists, along with botanists, were given interesting opportunities of seeing and collecting the characteristic plants and animals both from cultivated and wild country on the expeditions to Nambour, the Blackall Range and the Maroochy River, Cleveland, Bribie Island in Moreton Bay, and on the expedition to Dr. Jean White's Prickly Pear experimental station at Dulacca. The field-work organised in connection with the section of Agriculture has already been noticed, in NATURE for November 19.

A good deal of research, definitely planned in relation to the Australian meeting, and resulting

FIG. 2.—British Association party on an expedition in southern Queensland.

in some cases in papers or addresses before the sections, was carried on during the voyage out by some members of the "Advance Party." On the blue-funnel liner *Ascanius* Prof. G. W. Duffield made observations on the variation in the force of gravity over the floor of the ocean, and Prof. W. A. Herdman examined and preserved samples of the plankton from the surface waters running continuously through fine nets, day and night, between Liverpool and Fremantle. Both these researches were very materially promoted by the managers of the Blue Funnel Line, who most generously fitted up a special laboratory for each of these purposes, and gave great assistance on board and other facilities for carrying on the scientific work. Some other researches were also carried out on other routes, and on the return voyages. Preliminary accounts of these investigations were given at the Australian meetings, but

FIG. 3.—One of the "Glass-house" mountains of Queensland named by Capt. Cook in 1770, visited by the British Association in 1914.

further results, both from the work on board ship and from some of the field work in Australia, may confidently be expected in the future.

W. A. H.

THE HEALTH OF THE EXPEDITIONARY FORCE.

WE may well be thankful that the news from the Front continues to report favourably of the general health of our men. It need scarcely be said that the labour of housing and treating so many severely wounded is colossal; and we know, all of us, that the proportion of heavily infected wounds is unhappily and inevitably high. Indeed, the wonder is, that every wound is not heavily infected: for we may be sure that no clothes, no hands, no skin, can be clean in action: we must not talk of "clean wounds," where complete cleanliness is impossible: we must only say that some wounds healed well, in spite of the conditions under which they were made.

The urgency and the frequency of the heavily infected wounds have brought all men to recognise the abiding rightness of "Listerism." There was a popular notion that "antiseptics" had been abandoned for "aseptics"; that the surgeons merely sterilised their instruments, dressings, etc., by heat, and no longer needed to use carbolic acid and other antiseptic substances; and, for a great part of the work of surgery, this popular opinion had reason. The set and formal operations, done after due preparation under conditions chosen for the patient's safety and convenience, have come to be more aseptic than antiseptic in their method—so far as it can be excusable to put the two words against each other. But, even over these formal exercises of surgery, there is room for some individualism; and the entire disuse of antiseptic agents is neither possible nor to be desired. Now, across the fine-drawn details of surgical practice in peace, and all the nicely calculated less and more of the antiseptic method and the aseptic method at this or that quiet hospital, comes the overwhelming rush of legions of gunshot wounds, many of them frightfully extensive, many left for days without sufficient treatment, and all of them more or less heavily infected.

The surface of the soil, cultivated and manured to the very utmost of its capacities, is loaded with bacteria of all sorts. Among them, are those of gangrene and of lockjaw. It is a hard fact, that the earth which our men are defending is one of their enemies: dug-up for trenches, ploughed-up by artillery fire, churned-up into mud, it provides "infective material" alike for the just and the unjust. Against these evils, Army surgeons are employing the full strength of "Listerism." Iodine, that excellent antiseptic, used in French surgery long before Lister, is coming into its own again; and the use of carbolic acid and of spirit is general and resolute. Of course, regard must be observed to the time which is lost between the infliction of the wound and the first systematic dressing of the wound; he is fortunate, who receives thorough treatment within 24 hours. Happily, against tetanus, our surgeons have the tetanus-antitoxin: it is a second line of defence, beyond the use of antiseptics. It can scarcely be reckoned on to cure tetanus, once the infection has flared up. But it can be reckoned on, with full confidence, to prevent the flaring up.

On the medical side of news from the Front, a matter of great interest is the occurrence of typhoid in the Belgian army. We may be sure that the fever is not limited to that army; and we may be fairly sure that there will be, before long, many more cases. It is, of course, the mild unsuspected cases, and the carrier cases, which are the danger. Something would be gained, if only the soldier would cover up his excrement, after the rule ordained by Moses; but he will not

always take the trouble, and typhoid thus is conveyed by flies, or by direct fouling of clothes and hands and food and utensils. Enough has been talked about water-borne typhoid and milk-borne typhoid: we want more talk about man-borne typhoid.

The protective treatment against typhoid has, on the whole, met with very little opposition, and none of real authority. Certain statements of disastrous results have been inquired into, and have been found not true. Not that no ill-effects have ever followed; but these are rare. The main fact, that the protective treatment is indeed protective, has been proved past all possibility of the least shade of doubt.

That old scourge of armies and of jails—typhus fever—has long ceased to trouble our country; probably most doctors now in practice have never seen a case of typhus. It may appear, some day, a most unwelcome visitor, in the western theatre of the war. It is conveyed by body-lice. It is said to be endemic in Silesia. It may find its way westward: or a trace of it, amid the desolation and wreckage of Belgian villages, may flare up into widespread trouble. Happily, the vigilance, the incessant zeal, of all branches of the Army Medical Service, and of all the many societies working at the Front for the welfare of the Army, will continue to bring forth good fruit. It is not possible, with such splendid organisation, such generous devotion, that any grave outbreak of infection should pass neglected; and, when the medical and surgical history of the present war comes to be written, it will be a fine record of good work accomplished on a grand scale.

STEPHEN PAGET.

THINKING ANIMALS.[1]

ABOUT ten years ago it became known that "Clever Hans," an Arab stallion owned by a Herr von Osten in Berlin, was able to answer arithmetical and other questions, tapping out the reply with his fore-foot. Notoriety led to heated controversy, and the appointment of committees to investigate. The second of these, under Prof. Stumpf, resulted in Pfungst's book, explaining everything in terms of signals consisting in slight movements made unconsciously by some person present knowing the answer. This seemed to have solved the problem finally until the appearance of Krall's book in 1912. The author, a wealthy jeweller of Elberfeld and friend of von Osten's, had after the latter's death continued to experiment, obtaining results which, he claimed, refuted Pfungst's explanation. This claim found support in a report signed by the zoologists, Kraemer, Sarasin, and Ziegler, asserting that signalling was excluded since correct answers were given even when none of the human participants was visible to the animal. The opinions expressed on Krall's book vary from that of Prof. Dexler—"a shameful blot on German literature," to that of Prof. Ostwald, who foresees that it will "as clearly mark the beginning of a new chapter in the doctrine of man's place in nature as Darwin's chief work did in its day."

As to the problem itself, a definitive solution could result only from a free and impartial testing of the animals; as it is one can only indicate probabilities. Intentional deceit is almost certainly too simplicist an explanation, and is in any case inadequate. On the other hand, the probability of obtaining correct answers by chance has been underestimated in view of the number of unsuccessful attempts and the greater frequency with which certain numbers occur. Very much must be allowed for this and other weaknesses of testimony, the demonstration of which has been one of the successes of applied psychology, but which, as every newspaper now shows, are seldom given weight in practice. They particularly affect some at least of the would-be crucial tests. Nevertheless much remains, of which the following main explanations have been offered.

The answers are evidence of mathematical intelligence. This, although a highly developed "number-sense" has been found in persons of low general ability, and even in the feeble-minded, conflicts with all that we know from other sources about the animal mind. Detailed scrutiny of Krall's account of his teaching shows that the problem often *could* not have been understood from his exposition. Again, the correcting of a single false figure is done quickly and certainly, as might be expected if signals were being given, since these would be facilitated by concentration of the signaller's attention; if the errors are mistakes of calculation it is odd. Finally, the inability of the animals to prove their understanding by action, compared with their eloquence in the language of taps, is extremely suspicious.

The answers are due to memory. The horse's memory is, no doubt, excellent for some things, and the theory has advantages, but also serious difficulties. To associate eight taps with one symbol and nine with another, the horse must be able to distinguish the two series. But it seems probable that animals cannot distinguish numbers beyond four or five. Rothe trained his dog to come only at the fifth whistle—but this only if the whistles were at regular intervals: his horse would take four lumps of sugar in preference to three, but confused four and five. Again, the horse's eye, while very sensitive to movement, is probably unsuited to the clear perception of complex visual forms such as written numbers, and, as a matter of fact, the animals seem to attend to the questioner more than to the blackboard. Finally, the mistakes in cube root, etc., questions strongly suggest the use of tips.

[1] (1) "Das Pferd des Herrn v. Osten (Der kluge Hans)." By O. Pfungst. (Leipzig: J. A. Barth, 1907.)
(2) "Denkende Tiere." By K. Krall. (Leipzig: W. Engelmann, 1912.)
(3) "Ueber den dermaligen Stand des Krallismus." By Prof. H. Dexter. Reprint from *Lotos*. Prague, vol. lxii., 1914.
(4) "Gibt es denkende Tiere?" By Dr. S. v. Máday. Pp. x+451. (Leipzig: W. Engelmann, 1914.)
(5) "Das Problem der Elberfelder Pferde und die Telepathie." By Prof. H. v. Buttel-Reepen. *Naturwissenschaftliche Wochenschrift*, 1914, No. 13.
(6) "Meine Erfahrungen mit den 'denkenden' Pferden." By Prof. H. v. Buttel-Reepen. *Naturwissenschaftliche Wochenschrift*, 1914, No. 16.
(7) "Eine Kritik der Leistungen der 'Elberfelder denkenden Pferde.'" By Prof. C. Schröder. *Naturwissenschaftliche Wochenschrift*, 1914. Nos. 21, 22.

The animals are responding to unconscious signals. Krall claims to have refuted this by "ignorant" experiments, but these are relatively few and seem all to have some weak spot. Thus Mackenzie reports that Rolf, the Mannheim dog, described a picture on a card held so that the holder could not see it; unfortunately, the picture was a red and blue cross, and there is reason to think that dogs are nearly colour-blind. Nevertheless, the fair number of "peep-hole" experiments and the case of the blind horse, Berto, seem to stamp as inadequate Pfungst's theory of *visually* perceived movements. Yet no other one mode of signal seems sufficient for all cases, while Hacker did actually get answers by moving his foot. Again, it is unlikely that the many individuals who have obtained answers should all make precisely the same unconscious movements. These difficulties disappear if we suppose the animals not to be blindly reacting to one specific stimulus, but to be interpreting more or less intelligently a general type of unconscious emotional or ideo-motor expression—movement, variation of respiration, etc.—possibly always complex and varying with the individual and occasion. Both horses and dogs are notoriously sensitive to shades of emotional expression, and recent work by the Pawlow school indicates that dogs can hear sounds so faint as the beating of the heart. It is true, any theory of unconscious signalling presents difficulties. Units, tens, etc., are tapped with different feet; the spelling of verbal answers is phonetic, and *spontaneous* utterances are recorded, including a letter dictated by Rolf! Can the subconscious be credited with so much? The solution, if it ever comes, can scarcely fail to illuminate, if not the animal mind, at least that of man. C. S.

THE REV. SIR JOHN TWISDEN.

AT his great age of nearly ninety, Sir John F. Twisden, whose death was announced last week, had survived most of his time, the generation of William Thomson and Todhunter, who could give a detailed account of his life and work, very valuable in its day.

The *Times* of December 8 describes the curious revival of the dormant baronetage, taken up by Sir John late in life, but his retirement from the Professorship of Mathematics at the Staff College must have taken place much earlier than 1885, as a consequence of the Cardwell scheme, which had decreed that mathematics was no longer of any use to a Staff Officer.

How Napoleon would smile if he could hear it! The sequel has proved that the economy was fatal to efficiency, when we consider the costly blunders of the Staff in South Africa; and here we are engaged in a war the greatest in the history of the world, and it is a Mathematical War.

After one old-fashioned battle in the open, both sides have dug in, and the war has become a vast siege, where all arms, horse, foot, and dragoons, are turned into garrison gunners, as I predicted in these columns nearly thirty years ago. This was the war for which we were not prepared.

Artillery science is our great requirement. Cavalry work is turned over to the motorist, to scour the country and round up the picturesque old-fashioned Uhlan. In South Africa we see how De Wet, the redoubtable cavalry leader, is run down ignominiously by motor-cars. It had not dawned on our military intelligence to compare by a slight mathematical calculation the available energy, in foot-pounds or ton-miles, of a gallon of petroleum against the equivalent weight of oats. But here was a specimen of the sort of education given by Twisden to the Staff College in his excellent "Practical Mechanics," a book too little known, but containing what Maxwell called the gentlemanly knowledge of the subject, which no Staff Officer should be without. The first chapter of it is a liberal education in elementary gumption, cleverly disguised in what appears a very simple question of no apparent difficulty, always, however, strong enough to unhorse the unwary.

This elementary instruction is being acquired by the junior ranks at the front at a vast expense, and the young officer can say, in the words of Hamlet, "I once did hold it, as our seniors do, a baseness to be scientific, and laboured much how to forget all learning; but now it did me yeoman's service." G. GREENHILL.

NOTES.

THE Hunterian Oration of the Royal College of Surgeons of England will be delivered by the president—Sir Watson Cheyne—on February 15, but the customary dinner in the evening will not be held.

WE regret to see the announcement, in the Proceedings of the Chemical Society, that Dr. C. R. Crymble, of University College, London, who was a fellow of the society, was killed in action on November 20.

WE learn from the *Times* that Prof. A. Van Geuchten, who was professor of systematic anatomy and neuro-pathology at Louvain University, has died suddenly at Cambridge, where he was receiving hospitality as a refugee.

PROF. C. S. SHERRINGTON, Fullerian professor of physiology at the Royal Institution, will deliver a course of six lectures at the institution on muscle in the service of nerve, on Tuesdays in January and February next.

THE President of the Board of Agriculture and Fisheries has appointed Mr. E. J. Cheney, lately one of the assistant secretaries of the department, to the office of chief agricultural adviser to the Board, and Mr. F. L. C. Floud to be an assistant secretary of the department.

PROF. T. A. JAGGAR, director of the Hawaiian Volcano Observatory, and a group of his assistants, had a narrow escape of their lives during a recent ascent of Mauna Loa. The volcano had become active, discharging large quantities of lava. The scientific

party, while making an ascent to study the eruption, was caught in a snowstorm and nearly overwhelmed by snowslides almost in the path of the lava streams.

La Nature has again made its appearance—the first time since the beginning of August, when publication was suspended on account of the war, most of its staff having joined the colours, while its printers, photographers, and engravers had ceased work. The date of No. 2149 of our interesting contemporary and namesake was August 1, and that of the next issue, No. 2150, is December 12. The articles in this issue deal almost entirely with subjects relating to the present war, among them being armoured trains, the spirit of science in the time of war, Cracow, the defence of Belgium by inundations, and dum-dum bullets. We trust that an unbroken and long existence is now in store for this weekly review of science and its applications to art and industry.

THE death is announced, at sixty years of age, of Mr. W. W. Rockhill, who did some valuable scientific exploration in China and Tibet under the auspices of the Smithsonian Institution about twenty-four years ago, and was the author of several important works upon this and other Oriental subjects. In 1884, when attached to the U.S. Legation in Peking, Mr. Rockhill began the study of the Tibetan and Chinese languages, with the view of undertaking exploration in Tibet. Four years later he started from Peking, and was across the frontier in March, 1889. Though he had to abandon his intention to visit Lhasa, he carried out successfully a long journey through much unknown country, and the narrative of his expedition is described in his "Land of the Lamas," published in 1891. His second great journey, described in his "Diary of a Journey through Mongolia and Tibet in 1891 and 1892," earned for him the gold medal of the Royal Geographical Society. During the eleven months which this journey lasted, Mr. Rockhill travelled 8000 miles, surveyed 3400 miles, and crossed 69 passes, all more than 14,500 ft. above sea-level. The volume in which he describes this journey takes a notable place among serious works on Central Asia. Mr. Rockhill was the leading American authority on Chinese matters, and he was on his way to Peking, where he was going to take a new appointment as adviser to President Yuan-Shi-kai, when he was taken ill. On December 4 he was removed from the steamer on which he was a passenger to the hospital at Honolulu, where he died from heart disease.

THE issue of the *British Medical Journal* for December 5 contains a statement of the schemes for research drawn up by the Medical Research Committee for the National Health Insurance Joint Committee, and since approved by the responsible Minister. The grants in aid of medical research arise from the annual revenue accruing from the penny in respect of each insured person (payable out of moneys provided by Parliament) to be applied for the purposes of research. The total amount available for 1914 is 56,000*l.*, of which 12,065*l.* has been spent on the purchase of Mount Vernon Hospital, and 7533*l.* on repairs, equipment, and salary. Administration is estimated to cost nearly 3000*l.*, and the research scheme, including a provision for additional grants for laboratory expenditure, more than 24,000*l.* This leaves an estimated balance of nearly 10,000*l.*, which, it is expected, will be reduced by the demands for special work needed in connection with the war. This special work is the extension of existing facilities for bacteriological investigation of infected wounds at the general military hospitals, including Territorial general hospitals, and the organisation for the adequate compilation of the medical and surgical statistics of the war. Among other subjects of medical research for which provision has been made are such matters as tuberculosis, rickets, and rheumatic infections. The research committee proposes, in order that researches carried out at different centres may be co-ordinated, to establish "special investigation committees" composed of one or more of the scientific members of the research committee, of members of the staff of the Central Institute, and of directors or workers in other research centres. The committee contemplates the publication of reports of work done upon special subjects with assistance from the research fund.

TWENTY-FIVE years have passed since the death of that eminent Russian traveller, N. M. Miklukho-Maklay. An account of his researches in geography and anthropology by Mr. N. A. Yanchuk has been translated in the December issue of *Man* by M. A. Czaplicka. He was a member of various scientific expeditions to the Canary and Madeira Islands, Morocco, New Guinea, Java, Malacca, and Australia. On his return to Russia in 1887 he commenced the preparation of a complete account of his travels, of which only one volume was completed before his death in the following year. Since then his papers have remained untouched. It may be hoped that on the conclusion of the war arrangements may be made for the publication of this valuable material. Meanwhile the bibliography of numerous papers contributed to scientific societies, which is appended to this article, will illustrate his marvellous activity and the wide range of his investigatons in geography and anthropology.

AN account of the trout or charrs of New England is given by Mr. W. C. Kendall, of the United States Bureau of Fisheries, in vol. viii., No. 1, of the Memoirs of the Boston Society of Natural History, and is rendered especially valuable by a series of seven very fine coloured plates illustrating the different species. Referring in his preface to these plates, which have been reproduced by Werner and Winter, of Frankfurt, the author says, "the paintings were made by the painstaking artist, Walter H. Rich, of Portland, Maine, of whose work the only possible criticism is it is too conscientiously true to life." The author has done his work with great thoroughness, both as regards the detailed scientific descriptions of the different species and varieties, and as regards the account of their habits and the conditions under which they are caught. The report should be equally useful to the naturalist and to the fisherman.

THE fishes obtained by the *Terra Nova* on Captain Scott's Antarctic Expedition are described by Mr. C.

Tate Regan in vol. i., No. 1, "Zoology," published by the British Museum (Natural History). Twelve of the species are regarded as new to science, four of them being new generic types. All but three of the twenty-five species collected by the expedition belong to the group Nototheniiformes, and the author gives a table (p. 26) showing in detail the distribution of this typical Antarctic group. Following the detailed descriptions of the fishes are two sections of a more general character, the first dealing with the distribution of Antarctic and Subantarctic fishes, and the second with the Antarctic continent during the Tertiary period. The author's conclusion is that neither the fresh-water fishes nor the marine fishes, whether Antarctic or South Temperate, support the theory that Antarctica has connected Australia with South America in Tertiary times, nor does he consider that the distribution of other groups of animals confirms such a view.

THE first part of a series of publications under the general title, "Beiträge zur Kenntnis der Land- und Süsswasser-fauna Deutsch-Südwestafrikas," which was published in the spring of the present year, contains some results of a scientific expedition to German South-West Africa, conducted by Dr. W. Michaelsen, of Hamburg, in 1911. At the same time Dr. Michaelsen publishes the first part of a series dealing with the marine fauna not only of the German colony but also of the whole West African coast, under the title, "Beiträge zur Kenntnis der Meeresfauna Westafrikas." A general account of Dr. Michaelsen's expedition, written by himself, is given in the former of the two works, which also contains reports on the Bryozoa by Kraeplin, the Copepoda by van Douwe, the Oligochæta by Michaelsen, the Isoptera by Sjöstedt, and the Skorpiones and Solifugæ by Kraepelin. In the volume on marine fauna the Hydrozoa and Pennatulacea are described by Broch and the Gephyrea by W. Fischer. Both publications are well illustrated with text figures and plates, and will add to the reputation as a scientific traveller which Dr. Michaelsen has already established by his reports of his earlier journeys to the Straits of Magellan and to Australia.

THE second part of vol. i. of the Journal of the Natural History Society of Siam contains a series of excellent papers and notes on the fauna of the country, and is well illustrated. It opens with the description of three new snakes, by Dr. G. A. Boulenger, and also contains the second part of a paper on the snakes of Bangkok, by Mr. Malcolm Smith, who, in a separate note, records for the first time the occurrence in Siam of that venomous species, the Indian crait (*Bungarus candidus*). The list of papers is completed by one on the birds of Bangkok, by Mr. W. J. F. Williamson, and a second, on those of the Raheng district, by Mr. C. S. Barton. In a note on the occurrence of an oily secretion in a wild ox during the "must" season, Mr. K. G. Gairdner, if we may judge from the figure he gives of its skull, appears to have mistaken a tsaine, or bautin (*Bos sondaicus porteri*), for a gaur (*B. gaurus*).

THE probable effects of the war on horse- and cattle-breeding in this country, and the measures that will have to be taken at its close to replenish our stock of horses, and at the same time to meet the great foreign demand for pedigree-cattle of all kinds which is likely to arise, loom large in the "Live Stock Journal Almanac" for 1915. Among others who write on this subject, Col. G. C. Ricardo is of opinion that in the future Government ought to buy remounts as two-year-olds, in order to help breeders. In another article Messrs. Stratton and Thomas discuss the future of cattle after the war, and point out the heavy drain that will almost certainly take place in our pedigree-stock when peace is proclaimed. Mr. Frank Webb writes to much the same effect, and suggests that in the not very distant future Russia will become a large buyer. The general opinion seems, indeed, to be that British and other pure bred stock will eventually oust the mongrel breeds from the civilised world; and, in consequence, that the prospect for breeders will ere long be of the brightest. In the matter of illustrations and in general get-up the present issue fully maintains the high reputation of this excellent almanac, which is certainly a wonderful shilling'sworth.

THE *Bulletin Trimestriel*, 1913, continues the summary of the plankton observations carried out by the International Council for the Exploration of the Sea during the years 1902–08. In this third part of the plankton *Résumé* ten groups are dealt with, the more lengthy articles concerning the Diatoms, the Radiolaria, and the second part of the Peridinidæ. In the 105 plates, most of which concern the Diatoms and Peridinidæ, the observed distribution of many important species is charted for the four quarterly cruises, distinctive symbols marking the different years of observation. In the text, so far as possible, a uniform method is preserved, the species of the several groups being discussed in relation to the seasonal horizontal and vertical range of occurrence in the different areas, the hydrographic relationships, and other points contributing to a fuller knowledge of the species and its part in the marine bionomics of North European waters. Much previous work has been incorporated, and when the magnitude of these international investigations is remembered, involving as they do the careful study of many thousands of hauls, made at some hundreds of stations more or less regularly visited during these years, and extending from the Barents Sea to the Bay of Biscay, the importance of this valuable work to marine science may be justly estimated.

THE annual report of the Royal Agricultural Society just issued is a record of a busy and successful year. The 1914 show at Shrewsbury was especially notable for the excellence of the exhibits, while the live-stock entries were, with one exception, the largest on record. Attention is directed to the cutting off of the supplies of kainit and other potash salts owing to the war. As no regular supply is to be obtained outside Germany, the farmer and the manufacturer of artificial manures are adversely affected. It is suggested that the practice of kelp burning may be revived, while Peruvian and other guanos may be used to supply the necessary potash to a limited extent. The Woburn

Experimental Station, besides carrying out the usual field trials on crops of various kinds, has tested the influence of magnesia in place of lime on a wheat crop. The value of crushed oats with separated milk as a food for young calves, both spring and autumn-born, is proved by the calf-rearing experiments begun in 1912 and still proceeding. In addition to much advisory work on the extermination of insect pests and animal parasites, the Zoological Department is conducting a research into the relation of pheasants to agriculture. The society's programme for 1915 is a full one, only a few features being omitted owing to the abnormal conditions now prevailing.

THE use of fish as cattle food has a novel sound, but it appears to be a common practice in various parts of the world. In Shetland and Iceland dry salt fish is fed to cattle, sheep, and even to horses. So long ago as 1853 Sir John Lawes carried out experiments at Rothamsted on the feeding of pigs with dried Newfoundland codfish. He found that the fish-fed pigs were fat and well ripened, and there was a very good proportion of increase to food consumed. Some recent experiments at the Agricultural College, Coimbatore, made at the instance of Sir F. Nicholson, director of the Madras Fisheries Bureau, have brought to light some further interesting facts. Mr. R. Cecil Wood, in describing the experiments, mentions that certain special cattle kept for display of strength at village festivals in Nandyal are fed with mutton, while it seems a fairly common practice to make use of bandicoots when killed by pounding them in a mortar and feeding them to cattle. In Mr. Wood's experiment two lots of heifers were fed on a dried fish diet and normal diet respectively. The animals took some little time to get used to the fish, but then ate it readily enough. At the end of six months the fish-fed heifers showed an average increase of weight of 54 lb. per head, as against 70 lb. for the normally fed animals. Although fish does not compare favourably with ground-nut so far as fattening value is concerned, it is suggested that on the coast a considerable saving might be effected by its use.

THE cultivation of rice in Spain affords an excellent example of the success attending a highly perfected system of agriculture. Most of the rice land is situated in the province of Valencia, where the cultivation was introduced at the time of the Moorish conquest. It is interesting to learn from Mr. E. J. Butler, in the *Agricultural Journal of India* for October, that many of the Oriental practices followed, and especially that of transplantation unknown elsewhere in Europe, are similar to those employed in India, and may probably be traced to the prolonged occupation of this district by an Eastern people. Although the total production of rice in Spain is the lowest of the six rice-growing countries, the yield per acre is double that obtained in Italy and Egypt, and more than six times the official figures for India. This result is due to the thorough cultivation of the fields with specially designed implements, to the system of transplantation, and the use of large quantities of suitable nitrogenous and phosphatic manures. The fear of encouraging malaria has hitherto acted as a deterrent to the extension of the area under rice in Europe, but at the recent International Rice Congress at Valencia the view was put forward that this prejudice is unfounded, provided that certain precautions are observed. If this view gains credence it can scarcely be doubted that there will be a material increase in the European production of this cereal.

THE relations between the two mineral representatives of iron disulphide, pyrite and marcasite, are further explored by E. T. Allen, J. L. Crenshaw, and H. C. Merwin in a paper in the *American Journal of Science* for November (p. 393). The formation of marcasite from acid and of pyrite from alkaline solutions is shown by experiment and also by natural occurrences. Wurtzite and zinc-blende are proved to have similar relations, the former being, moreover, the unstable form.

IN view of the rarity of fossil remains of apes and monkeys much interest attaches to the description by Dr. A. Smith Woodward, in vol. lxx (pp. 316–20, plate xliv.) of the Quart. Journ. Geol. Soc., of an form of the jaw at and near the point of insertion *fontani*, from the Upper Miocene of Seo de Urgel, Lérida, Spain. In several respects, notably in the form of the jaw and near the point of insertion of the digastric muscle and in the small size of the first molar, Dryopithecus approximates to the contemporary macaque-like genus Mesopithecus, and is therefore a primitive type.

PROF. A. C. LAWSON, at the invitation of the Geological Survey of Canada, has revisited the pre-Cambrian area of Rainy Lake, where he first demonstrated in 1885 and 1887 the intrusive nature of much of the "Laurentian" gneiss. His results are now issued as Memoir 40 of the Canadian Survey, dated 1913. The names Coutchiching and Keewatin are retained for the two series penetrated by the Laurentian gneiss, the former being free from volcanic matter, and the latter, overlying it, being largely volcanic. The second intrusive gneiss, which is later than the Seine (Huronian) sedimentary series, is now styled Algoman by the author. The influence of Prof. Lawson's original papers has been far-reaching. As recent evidence, we may mention Mr. A. L. Hall's address on the Bushveld Complex (Proc. Geol. Soc. South Africa, 1914 p. xxii.), and Mr. P. A. Wagner's account of the gneisses of Southern Rhodesia (Trans., *ibid.*, vol. xvii., p. 39).

IN the September issue of the Proceedings of the Philadelphia Academy, Mr. D. M. Barringer adduces further evidence in favour of the theory that the so-called meteor crater of Arizona, in place of being due to volcanic action, is really the result of the impact of a vast fall of meteorites. Of the occurrence at a remote epoch of such a fall there is ample evidence. One of the points on which the author lays special stress is the occurrence in the crater of large quantities of a quartz-glass, which was undoubtedly formed by the fusion of part of a bed of white sandstone occurring at a depth of about 350 ft. below the level of the plain, and not outcropping for a distance of seventy miles. This quartz-glass is stained with nickeliferous iron, which could only be of meteoric origin, and this

fact, coupled with the lack of any evidence that crystalline quartz can be fused by the heat engendered during volcanic action, is regarded as conclusive testimony in favour of the impact theory. Corroborative evidence is afforded by the fact that intense heat is produced by the impact of big shells fired against armour-plating. The mass to which the origin of the crater is attributed was probably a dense cluster of iron-meteorites, which may possibly have formed the head of a small comet.

THE publications of the Norwegian Meteorological Institute for the year 1913 (Rainfall Observations and Year-book, both containing actual readings and mean values) are prepared in the usual careful way, and scarcely call for special remarks beyond those referred to in our previous issues. The year-book contains hourly and other observations at Green Harbour, Spitsbergen; the summary for 1912 shows that the yearly temperature was −10·4° C.; January, −24·4° (February −26·3°), July, 4·2; maximum, 9·9° on July 22; minimum −44·3° on March 31. The yearly rainfall (or melted snow) was 305 mm., on 124 days. The annual report shows that the success of ordinary weather forecasts, and notices for herring fisheries, was very satisfactory; storm warning telegrams are issued from Bergen. We note that Mr. A. S. Steen, formerly assistant-director, has succeeded Prof. H. Mohn in the directorship of the Meteorological Service, which position the latter held with much distinction from the establishment of the service in the year 1866.

SOME time before the loss of the *Titanic* Prof. Barnes, of Montreal, carried out a series of measurements of the temperature of the sea in the neighbourhood of icebergs, and came to the conclusion that the presence of an iceberg could be detected by a slight rise of temperature it produces in the sea-water around it In the summer of 1912 a party from the Bureau of Standards took automatic records of the temperature of the water during the patrol of the U.S.S. *Chester* and *Birmingham* in the North Atlantic, and their results are published in vol. x. of the Bulletin of the bureau. They show that the changes of temperature which occur in the sea far removed from icebergs are at least as great and sudden as those found in the vicinity of bergs, and that no positive conclusions as to the presence of bergs can be drawn from such changes. They find also that in the neighbourhood of a berg the temperature of the water is reduced more often than raised. These conclusions are almost identical with those arrived at during the cruise of the *Scotia*, sent out to the Newfoundland bank by the Board of Trade in the summer of 1913, except that on the *Scotia* small rises of temperature in the neighbourhood of bergs were more often recorded.

THE Bureau of Standards at Washington has issued a circular (No. 47) in which the tables of equivalents of United States customary and metric weights and measures are revised and brought up to date. It contains a useful series of conversion tables giving the equivalents of the metric and customary weights and measures from 1 to 999 units. From the introduction and definitions which precede the tables it would appear that for all practical and most scientific purposes the United States yard and pound are the same as those in the United Kingdom. The United States gallon (which is used for the measurement of liquid commodities only) is, however, only five-sixths of the imperial gallon, while the United States bushel (used only in the measurement of dry goods) is approximately thirty-two thirty-thirds of the imperial bushel. The bushel and gallon of the United States are not connected by the relation 8 to 1 as are those used in this country. The troy pound and the apothecaries pound are apparently still recognised in the United States as customary weights, although they have long died out in Great Britain. It may be of interest to note that the fundamental standard metre established in the United States by Act of Congress and by order of the Treasury is the international prototype metre, whereas the primary standard metre in the United Kingdom is the national prototype No. 16, which is shorter than the international metre by six-tenths of a micron.

AN important paper on the resins present in hops (*Humulus lupulus*, L.) has been published by Ö. Winge and J. P. H. Jensen in the *Comptes rendus* of the Carlsberg Laboratory (vol. ii., part 2, p. 116). It is shown that in the past a mistake has been made in considering one of the resins of hops, namely, the so-called γ-resin, as valueless; on the contrary, during the brewing process it both gives taste to the wort and helps in the precipitation of proteins. The total quantity of resins extracted from the hops by cold ether and determined by titration is an approximately accurate expression of the bitterness value of hops. Other data recorded show that the analytical methods hitherto used, which are based on the separation of the so-called soft resins from the hard resins, rest upon an insecure basis and give misleading results.

NO. 4 of the Proceedings of the Institute of Chemistry contains an account of the steps taken by the institute in conjunction with the Board of Trade, the Society of Chemical Industry, and other bodies, to consider the needs of this country as regards chemicals, dyestuffs, glass, and porcelain vessels, which have hitherto been manufactured in enemy countries. A committee, which was appointed on September 22, after taking evidence, has reported that there is every prospect of the chemical glass industry being taken up and worked satisfactorily in this country provided that the manufacturers can be afforded some guarantee of permanency for their enterprise, and that they may have some reasonable assurance that at the conclusion of the war the newly developed industry will not suffer from foreign competition, hitherto made possible by economic conditions which do not prevail in this country. Several firms have stated their intention to undertake the manufacture of chemical glass ware, whilst others are already experimenting with a view of supplying porcelain, crucibles, basins, and funnels. Later, at a meeting of the council of the institute, held on October 30, it was resolved to appoint an advisory committee to conduct research on glass, to be carried out in the laboratories of the institute with a view to arrive at

suitable formulæ to be freely available to manufacturers. Another committee has been formed to consider the needs of this country as regards laboratory reagents and the standards of purity necessary for such substances.

PROBABLY the most interesting structural steel work on the new Lötschberg-Simplon Railway is the steel arch bridge over the Bietsch Valley, of which an illustrated description appears in the *Engineer* for December 11. This bridge is remarkable for the fact that it is built on a short-radius curve of only 300 metres, and also on a gradient of 22·2 per 1000. The situation is over a craggy ravine, between two tunnels piercing the spur on either bank. The arch has a span of 95 metres between the centres of the hinges and a rise from this chord of 23·79 metres. Supported partly upon this arch and partly by the masonry approach arches are two trussed girder spans. These girder spans are attached to the back of the central arch by means of pivoted expansion brackets, and this part of the design is of peculiar interest in view of the complexity of the movements arising from change of temperature and vertical and lateral loading. The three structural elements in the bridge are all rectilinear, while the bridge floor and its bracing alone are curved and continuous between the pier abutments.

THE thirty-first annual issue of the "Year-Book of the Scientific and Learned Societies of Great Britain and Ireland" has now been published by Messrs. Charles Griffin and Co., Ltd. This useful reference volume is a record of the work done in science, literature, and art during the session 1913–1914 by numerous societies and Government institutions, and has been compiled from official sources. On the whole it provides a comprehensive survey of the activities of associations with which it is concerned, but we have failed to find any reference to the Wireless Society of London, the Illuminating Engineering Society, and the Historical Association. It is a pity, too, that in a volume published at the end of 1914 the extended reference to the British Association should deal almost wholly with the 1913 meeting at Birmingham. The volume, the price of which is 7*s*. 6*d*. net, deserves a place in every reference library.

MESSRS. J. WHELDON AND CO., 38 Great Queen Street, W.C., have just issued a classified list of books and other works on mineralogy, metallurgy and mining, geology and palæontology, and related subjects. The catalogue includes recent purchases and selections from several libraries, and it should be seen by geological bibliophiles and librarians of scientific societies

MESSRS. G. P. PUTNAMS SONS ask us to say that the price of "The Essence of Astronomy," by Mr. E. W. Price, reviewed in NATURE of November 12 (p. 280), is not 10*s*. 6*d*. net as there stated, but 3*s*. 6*d*. net.

OUR ASTRONOMICAL COLUMN.

COMET 1913*f* (DELAVAN).—The following ephemeris is taken from the Ephemeris-Circular of the *Astronomische Nachrichten* (No. 469, 1914), being communicated by J. Fischer-Petersen and Vinter Hansen of the Copenhagen Observatory:—

12h. M.T. Berlin.

	R.A. (true) h. m. s.	Dec. (true) ° ′	Mag.
Dec. 17 ...	16 20 40 ...	−4 45·9 ...	5·9
19 ...	24 6 ...	5 37·4	
21 ...	27 29 ...	6 27·7 ...	5·7
23 ...	30 47 ...	7 17·0	
25 ...	34 2 ...	8 5·2 ...	5·8
27 ...	37 14 ...	8 52·5	
29 ...	40 22 ...	9 38·9 ...	5·9
31 ...	16 43 27 ...	−10 24·3	

Two photographs of this comet are reproduced in the current number of the Monthly Notices of the R.A.S. (vol. lxxv., November, 1914). They were taken on September 20 and 26 with the 3¼-in. portrait lens and 30-in. reflector of the Royal Observatory, Greenwich.

THE SPANISH SOLAR ECLIPSE EXPEDITION.—The Madrid Observatory dispatched an expedition to Theodosia, in the Crimea, to observe the total eclipse of the sun on August 21. The party included MM. Ascarza, Carrasco, and Tinoco, with one or two voluntary helpers. The weather seems to have been favourable at their station, and the results obtained were satisfactory, and are briefly described in the *Comptes rendus* for November 30 (vol. clix., No. 22, p. 738). The corona is described as of a form analogous to that of minimum sunspots with polar rays a little more pronounced. Photographs of the spectra of the corona and chromosphere were successfully secured, and, in M. Carrasco's case, with special attention to the red, yellow, and green regions. While details regarding the wave-lengths will be published later, M. Carrasco directs attention to a red coronal radiation, the wave-length of which he gives as λ 6373·87 Å U. He describes the green coronal radiation as being very feeble or absent.

THE RECENT TRANSIT OF MERCURY.—Accounts of the observations of the transit of Mercury in November last are published by numerous observers in several journals. In the Monthly Notices of the Royal Astronomical Society (vol. lxxv., No. 1, November) papers are communicated by the Royal Astronomers of Greenwich and Edinburgh, Mr. R. Jonckheere, Prof. Fowler, and Dr. J. L. E. Dreyer. The different phases seemed to have been well observed at Greenwich, and the Astronomer Royal states that "none of the observers saw the 'black drop,' a halo round Mercury or a bright spot on the planet. The phenomenon appeared just as might have been expected from geometrical considerations." This communication is accompanied by a plate illustrating seven positions of the planet, taken with the photoheliograph just about the times near the beginning of the transit. M. Jonckheere discusses the 368 measures of the diameter of the planet as made at the Royal Observatory, Greenwich, by several observers during the transit. At the Royal Observatory, Edinburgh, no distinctive marking on the planet's disc could be detected nor any halo, and the second internal contact was noted as "quite clean," no ligament of any kind being visible.

Prof. Fowler's observations corroborate the above. An additional observation by him to determine by spectroscopic means whether there was any strengthening of the telluric lines near the limb of the planet led him to conclude that no effect of the kind was seen. Dr. Dreyer's observations at the Armagh Observatory show that while he observed no halo round the planet, he noted the black drop at egress and a bright point or dot on Mercury's disc. In the *Comptes rendus* for November 23 (vol. clix., No. 21) MM. Gonnessiat and Chrétien present two notes on the transit.

ATMOSPHERIC POLLUTION.

AT the International Conference on Smoke Abatement held in London in March, 1912, a committee representative of the Smoke Abatement Societies and of the more progressive municipalities of the United Kingdom was appointed, to promote the systematic and scientific study of atmospheric pollution, in the urban and industrial districts of this country. Dr. W. N. Shaw, director of the Meteorological Office, was elected chairman of this committee. Numerous meetings were held in London during 1912 and 1913, in order to select a standard method and type of apparatus for collecting the impurities, and also to make preliminary arrangements with the various local authorities who had consented to take part in the investigation. The actual observations were commenced in twenty-two different cities and towns in March of the present year, using the method and standard form of soot- and dust-gauge recommended by the committee.

The principle of the method used is that of collecting the soot and other impurities that fall by their own weight, or are carried down by the rainfall in

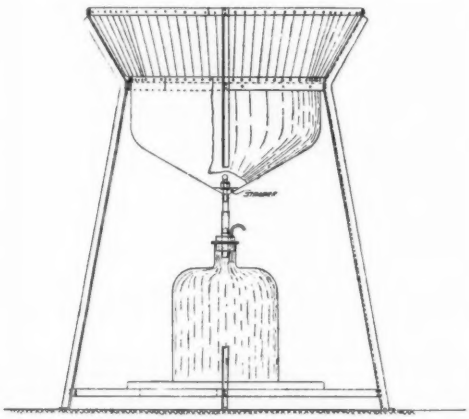


FIG. 1.—Soot Gauge. Standard form.

one month, in a large funnel of enamelled iron, with a catchment area of four square feet. These soot and dust gauges are placed in some central position of the town or district on the ground-level, in open spaces free from wind eddies and from abnormal soot and dust. The collected water and deposit are removed once a month, for measurement and examination by the official city chemist, and the following constituents of the rainfall and solid deposit are recorded:—Volume of water collected, total solids, total soluble matter, total insoluble matter, tarry matters, non-tarry carbonaceous matter, sulphates, chlorides, ammonia and lime. The relationship between the amount of tarry matter and the total carbonaceous matter enables one to judge how far the domestic chimney is responsible for the soot-fall in each locality. Factory furnaces and factory chimneys produce under normal conditions little tarry vapour, for the temperature of the furnaces is sufficiently high to ignite and burn these vapours before they escape into the atmosphere. The greater portion of the tar in town and city smoke comes, therefore, from the coal used for domestic heating and cooking purposes.

The standard gauge is shown in Figs. 1 and 2. It consists of a circular open-topped vessel of enamelled iron, supported in a heavy galvanised iron frame, and is provided, as shown, with bottles for holding the month's fall of soot- and dust-laden rain-water. On the first or last day of each month the soot and other solid matter deposited on the interior of the vessel is rinsed down with some of the collected water, and a new set of bottles are placed in position to receive the new month's rainfall.

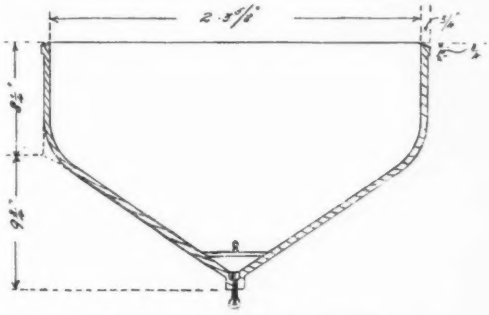


FIG. 2.—Section of Standard Soot Gauge.

The health authorities of the following towns and cities are joining in the observations:—Aberdeen, Ayr, Birmingham, Coatbridge, Exeter, Glasgow, Greenock, Hull, Liverpool, Leith, London (County Council), London (City Corporation), London (Meteorological Office), Malvern, Manchester, Newcastle-on-Tyne, Oldham, Paisley, Plymouth, Sheffield, Stirling, Wishaw, and York. In many cases two or three gauges will be installed at different centres, but at present London is the only city from which returns

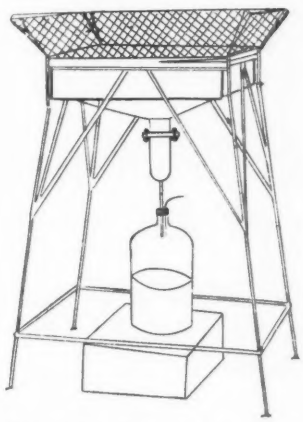


FIG. 3.—Soot Gauge used for *Lancet* observations.

have been published where more than one gauge is in use.

The committee, which is now receiving and co-ordinating the results, has just published the figures obtained in thirteen of the above observation centres in April and May of this year. Although these are incomplete, owing to the absence of results from Manchester, Glasgow, Sheffield, Leeds, Newcastle, and other important manufacturing towns, the figures

are sufficiently interesting and important to be reproduced here.

TABLE I.—*Summary of Reports per Month ending April* 30, 1914.

Place	Rainfall in millimetres	Metric tons of deposit per sq. kilometre in month of April				
		Insoluble matter			Soluble matter	
		Tar	Carbonaceous other than tar	Ash	Loss on ignition	Ash	Total solids
England—							
Exeter	32·30	0·04	2·05	4·71	0·97	1·61	9·38
Kingston-on-Hull..	10·25	0·08	2·71	4·76	0·94	2·50	10·99
Liverpool	22·23	0·36	2·18	8·01	2·40	3·02	15·97
London—Embankment Gardens (Central) ...	15·61	0·27	5·38	6·31	0·72	3·03	15·71
Golden Lane (East)	19·27	0·03	1·41	2·24	1·15	2·24	7·07
Meteorological Office (West)..	18·70	0·05	2·42	5·63	1·87	2·61	12·59
Malvern ...	32·19	0·00	0·14	0·21	0·39	1·03	1·77
Newcastle-on-Tyne	15·31	0·17	4·05	10·55	0·98	2·17	17·92
York	13·23	0·11	2·17	3·26	0·96	1·69	8·19
Scotland—							
Greenock	94·70	0·03	1·32	3·13	1·71	3·45	9·64
Leith	24·63	0·08	1·01	3·27	1·53	1·02	6·91
Paisley	75·80	0·08	4·17	6·46	2·42	2·73	15·87

TABLE II.—*Summary of Reports for Month ending May* 31, 1914.

Place	Rainfall in millimetres	Metric tons of deposit per sq. kilometre in month of May				
		Insoluble matter			Soluble matter	
		Tar	Carbonaceous other than tar	Ash	Loss on ignition	Ash	Total solids
England—							
Birmingham... ...	35·60	0·18	4·79	15·92	1·71	7·26	29·86
Exeter	41·80	0·05	2·37	3·56	0·79	1·97	8·74
Kingston-on-Hull..	44·61	0·16	3·86	4·51	2·50	3·39	14·42
Liverpool	56·14	0·16	4·11	8·96	2·47	4·94	20·64
London—Embankment Gardens (Central) ...	21·47	0·61	7·18	6·51	0·86	2·62	17·78
Golden Lane (East)	46·74	0·08	3·37	5·72	1·68	3·74	14·59
Meteorological Office (West)..	35·20	0·05	1·57	2·96	0·00	2·11	6·69
Malvern	34·76	0·02	0·27	0·41	0·69	1·25	2·64
Newcastle-on-Tyne	29·19	0·12	3·18	5·56	0·93	1·93	11·72
York	33·73	0·02	0·85	3·15	1·08	1·35	6·45
Scotland—							
Greenock	52·30	0·04	1·93	4·51	1·39	2·25	10·12
Leith	46·10	0·49	0·79	2·92	1·19	1·19	6·58
Paisley	49·68	0·15	4·53	6·66	1·20	1·99	14·53

Adding together the results recorded in Tables I. and II., and arranging the towns in order of the magnitude of their fall of soot and dust in the two months, we obtain the figures given in Table III.

TABLE III.—*The Soot and Dust Fall of various English and Scotch Towns in April and May.*

Name of town or city	Metric tons per sq. km. in two months			
	Total solids		Tar, soot, and grit	
Liverpool	36·51		23·78	
Paisley	30·42		22·05	
Newcastle	29·64		23·63	
Kingston-on-Hull...	25·41		16·08	
London (Central)...	33·5	Average 24·8	26·26	Average 17·3
,, (East) ...	21·6		12·85	
,, (West) ...	19·2		12·69	
Greenock	19·76		10·96	
Exeter	18·12		12·78	
York	14·64		9·56	
Leith	12·23		8·56	
Malvern	4·45		1·05	
Birmingham (one month only)	29·86		20·89	

The difference between the figures in the second and third columns of this table gives the soluble solid matter brought down by the rain.

It is surprising to find that the atmosphere of Birmingham and of many northern towns is considerably dirtier than that of London, which in this respect has a reputation it does not deserve. Malvern is seen to be far the cleanest town in the list, since the total soot and dust-fall in April and May, 1914, only amounted to 4·45 tons per sq. km., or to about one-fifth that of London, and one-eighth that of Liverpool during the same two months.

Figs. 1 and 2 are sectional elevations of the standard gauge, while Fig. 3 shows the gauge used for the observations of London's soot-fall, carried out in 1910–11 by the *Lancet* and the Coal Smoke Abatement Society.

THE NATURAL HISTORY OF AN AMERICAN DESERT BASIN.[1]

THE staff of the Botanical Research Department of the Carnegie Institution of Washington has made many valuable contributions to natural science, particularly in the study of desert vegetation, at the Desert Laboratory, Tucson, Arizona. The recently issued monograph on the Salton Sea is in many respects unique, for it deals with a remarkable series of phenomena, opportunities for the study of which are but rarely presented. That the Desert Laboratory workers have taken full advantage of this opportunity is evident from the perusal of this volume, interesting to the geologist, the geographer, and, above all, to students of plant ecology. The chief interest of this fine piece of co-operative research centres, as the editor and chief contributor point out, around the fate of organisms overwhelmed by floods, in the physical changes which follow emersion, and in the biological mechanism of reoccupation of sterilised areas as they emerge from the water—episodes which must have been repeated many times in the history of the earth's surface. The report gives the results obtained by the investigation from various points of view of the phenomena presented by a desert basin

1 "The Salton Sea: a Study of the Geography, the Geology, the Floristics, and the Ecology of a Desert Basin." By D. T. MacDougal and Collaborators. Pp. x+182+32 plates. Publication No. 193. (Washington: Carnegie Institution, 1914.)

which has been the scene of alternate submergence and desiccation.

The Cahuilla basin, lying to the west of the lower (southern) portion of the main delta of the Colorado River, was in Tertiary times cut off from the sea and so became a brackish inland lake (Lake Cahuilla). The lake bed, now called the Salton Sink, has its upper margin about 20 ft. above mean tide-level, while its lowest point, now beneath the water of the present lake (Salton Sea), is 280 ft. below this level. On either hand of the Sink, which is oblong in outline (about eighty miles long and thirty miles in greatest width), there rise arid and sun-scorched low mountains, chiefly of granite, the slopes and waterless cañons of which bear a scanty vegetation. The Sink is practically a level plain, with no irregularities of surface to vary the effects of sun and wind, with a uniform temperature and uniform deficiency of atmospheric humidity and precipitation, the latter being on the average 2·7 in. a year. The ancient lake which originally filled the Sink had almost or entirely disappeared by evaporation, leaving a series of beach-lines, but during 1905 and 1906 the cutting of canals and the resulting escape from control of the Colorado River water resulted in a partial re-flooding of the basin and the formation of the Salton Sea, threatening the restoration of the former lake conditions and necessitating the removal of the Southern Pacific Railway track for sixty-seven miles to a higher bed. In 1907, however, the railway engineers stopped the deluge by re-diverting the Colorado water to the Gulf of California, and the gradual disappearance by evaporation of the Sea then began and is still in progress. Since 1907 the average annual rate of lowering of level by evaporation has been about 5 ft., while the concentration of the water has risen until the proportion of total solids is now more than 1 per cent. Succeeding the chapters on the geology, geography, climate, and water analyses, the remainder of the report (pp. 48–182) is devoted to the biological results obtained. Prof. G. J. Peirce gives an interesting account of the behaviour of the micro-organisms found in the Salton Sea, and in the strong brines from which salt is crystallising out naturally or in the artificial salt-pans on the shores of the lake. It has long been known that various organisms live under what are commonly regarded as fatal conditions—*e.g.* the mould-fungi which thrive on solutions of strychnine, formalin, carbolic acid, etc., the insects in oil-wells and asphaltum, those in hot springs and in snow, and so on—but in these cases the conditions are fairly stable, and it is harder to understand how organisms like the brine-shrimps (Artemia) and various protozoa, flagellates, and algæ found in the Salton Sea and other strong brines can exist under conditions ranging from rain-diluted sea-water to concentrated brine from which common salt crystallises. The lower organisms upon which the brine-shrimps and protozoa feed are mainly Pyramimonas, Dunaliella, Carteria, and various bacteria. The latter are entirely different from the bacteria which cause putrefaction in waters of the usual concentrations, and which are killed by the Salton brine—a concentrated solution of sodium chloride and of magnesium salts. The most conspicuous are a chromogenic form which gives a red colour to the salt in the salt-pans and to fish pickled in the salt, and a cellulose-destroying form which attacks stems and other plant-remains submerged in the lake.

A rocky island in the Salton Sea, Southern California, formerly submerged but now exposed by the recession of the lake owing to continued evaporation. The rock shows colonisation by a desert shrub, *Pluchea sericea* (Compositæ).

The present flora of the Salton Sink includes 179 species of seed-plants, the great majority being salt-plants (halophytes) and plants adapted for life under dry conditions (xerophytes); the former are mainly members of the Chenopodiaceæ. Apart from the salt-mud plants, the vegetation of the Sink is a part of the general flora of the Colorado desert, differentiated mainly by the great preponderance of species of the orache genus (Atriplex) in its composition, and it is of a remarkably uniform character. Three main communities or associations can be distinguished, according to the nature of the soils—coarse-grained, detrital slopes, clays, and mound-forming drifted materials.

The longest report (pp. 115–72) is that by Dr. MacDougal, dealing with the movements of vegetation in the area. The phenomena observed on the emersed

lands of the Sink are widely different from those hitherto investigated in the case of Krakatau, the cooling lavas of the Hawaian Islands, newly-made land about the mouths of rivers, etc. The chief features in the re-vegetation of the beaches successively exposed each year by the recession of the water are described in detail, but the following were the chief points to be taken into account in noting the progress of re-vegetation. As the salt content of the water increased by about 18 per cent. in each succeeding year, each emersed strand would be saturated with a soil solution of the concentration and composition prevalent in the period preceding emergence, and the desiccation of the emersed strands would proceed at a rate determined by the character of the soil (*e.g.* its capillary raising power), and by the composition of the infiltrated lake water. The re-vegetation of the strand bared in 1907 was chiefly due to the rising water picking up seeds lying on the surface and leaving them on the wet flats, but since that year the plants invading the new strands were carried there as seeds by the wind, by flotation, or by birds, only those plants surviving as could withstand the rapid warming of the shallow water on the mud flats, which increased its toxicity for seeds and seedlings, and the rapid desiccation of the surface soil, which increased the difficulties of the rooting and establishment of the plants.

The report is illustrated by thirty-two beautiful collotype plates, and interesting as are the results already obtained, the continued investigation of the phenomena presented by the re-vegetation of this sterilised desert basin area under difficulties which will become increasingly great as evaporation proceeds will doubtless yield even more valuable results in the future. F. C.

FINISHING TEMPERATURES OF RAIL STEEL.

REPRINT No. 38 of the Technologic Papers of the Bureau of Standards, by Messrs. Burgess, Crowe, Rawdon, and Waltenberg, deals with observations on the finishing temperatures and properties of steel rails. The principal objects of the research were to "determine from measurements taken in representative rail mills, the present American practice regarding the temperatures at which rails are rolled, to demonstrate the ease and accuracy with which such temperatures may be measured, and to find out what the 'shrinkage clause' in rail specifications really means."

The authors have found that ingots for rails are rolled at temperatures ranging from 1075° to 1150° C., and that the variation from one ingot to another in a series of 20 to 40 is only 10° to 20° C. The rails are finished at temperatures which may vary between 880° and 1050° C., but which usually come within 50° C. of 935° C. With uniform mill practice the rails of 100-lb. section will be finished at some 10° to 20° C. hotter than 90-lb. rails, and about 50° C. hotter than 75-lb. rails. The melting or freezing range of such steels extends from about 1470° to 1530° C., *i.e.* to nearly the melting point of iron. The critical Ac 1 point was found to occur within 7° C. of 732° C. for the ten samples of Bessemer and open-hearth steels examined. On cooling the corresponding Ar 1 point occurs between 680° and 650° C.

In all cases, therefore, the temperature at which the rolling of the rails ceases was at least 200° C. above the critical point, and there is no doubt that the rolling temperatures could with advantage have been carried much lower than they actually were. A rail of 100-lb. section, cooling freely in the air from 1070° C., reaches the recalescence point (Ar 1) in about 8½ minutes; and the maximum difference in temperature between the centre and the outside of the head is about 85° C. at 1000° C., becoming 0° at the recalescence point. A comparison of the "shrinkage clause" specification with the expansion of rail steel shows that this clause permits the finishing of rails at 1120° C., which is 450° C. above the critical range of such steel and is *above* the temperature at which many rail ingots are rolled in practice. In its present form, therefore, the clause has absolutely no significance.

FOREST ENTOMOLOGY.

A VALUABLE Bulletin (Entom., No. 7) of the Canadian Department of Agriculture on forest insect conditions in British Columbia, has been lately issued by Mr. J. M. Swaine. The author deals mostly with the Scolytidæ injurious to the more important species of pine, spruce, and fir; he gives interesting summaries of the life-histories, illustrated by excellent figures of the beetles, their larvæ, and their characteristic brood-galleries in the bark of the trees.

The "large larch sawfly" (*Nematus erichsonii*)—notorious for its ravages in the Cumbrian Lake district—continues to occupy the attention of zoologists in the University of Manchester. Mr. R. A. Wardle contributes to the last number of the *Journal of Economic Biology* (vol. ix., No. 3) some notes on the life-histories of two of its parasites hitherto unrecorded; these are *Zenillia pexops*, a Tachinid dipteron, and *Hyparnblys albopictus*, an Ichneumon-fly. The first-stage larva of the latter, with its relatively big head, elongate tail-process—variously interpreted as a blood-gill or a pro-leg—and paired, limb-like outgrowths on the body-segments, is remarkable. Several of these young grubs may occur in one sawfly caterpillar, but apparently only one of them is able to pass through the subsequent larval stages and become in due course a pupa. There appears to be rather severe competition among the various parasites of the Nematus, so that there may be danger of their weakening one another in the process of reducing the numbers of their host.

The pine weevil (*Hylobius abietis*) is one of the most abundant of our native woodland insects. Mr. J. W. Munro has lately published (Proc. R. Phys. Soc. Edinb., vol. xix., No. 6) the fullest account yet available of the reproductive organs in both sexes.

AUSTRALIAN HANDBOOKS FOR THE BRITISH ASSOCIATION.[1]

IN connection with the recent meeting of the British Association in Australia, official handbooks were issued for the Commonwealth and for all the States—Western Australia, South Australia, Victoria, New South Wales, Queensland, and Tasmania. Copies of all were distributed among the visiting party, in most

[1] The Commonwealth of Australia. Federal Handbook prepared in connection with the 84th meeting of the British Association for the Advancement of Science, held in Australia, August, 1914. Edited by G. H. Knibbs. Pp. xvi+598. (Melbourne: Mullett.)

Handbook and Guide to Western Australia. Prepared for the Members of the Advance Party of the British Association for the Advancement of Science. Pp. vi+118. (Perth: F. W. Simpson, 1914.)

Handbook of South Australia. British Association for the Advancement of Science. Australian Meeting, 1914. Adelaide. Joint Editors: D. J. Gordon and V. H. Ryan. Pp. 328. (Adelaide: R. E. E. Rogers, 1914.)

British Association for the Advancement of Science. Australian Meeting, 1914. Handbook to Victoria. Prepared under the direction of the Victorian Executive Committee, by A. M. Laughton and Dr. T. S. Hall. Pp. xvi+382. (Melbourne: A. J. Mullett, 1914.)

British Association for the Advancement of Science, 1914. Handbook for New South Wales. Pp. xiv+621. (Sydney: E. Lee and Co.)

Our First Half-Century. A Review of Queensland Progress. By Authority of the Government of Queensland. Pp. xxviii+258. (Brisbane: A. J. Cumming, 1909.)

British Association for the Advancement of Science. Tasmanian Handbook. Pp. iv+348. (Hobart: J. Vail, 1914.)

instances before the travellers had left home, so that it was competent for the recipients to inform themselves thoroughly on Australian topics before reaching the country. Members joining locally in Australia received the Commonwealth volume and that relating to their own State. The volumes are not uniform in style, though they were all prepared on an approximately uniform plan, specially for the occasion, with the exception of the Queensland volume, which was that originally issued in 1909, by authority of the Government, under the title of "Our First Half-Century," in commemoration of the jubilee of the State.

The volumes form a fine monument to the scientific achievements of Australian workers, for they contain chapters by acknowledged experts in every department of science—natural, economic, social, and political. Thus the Commonwealth volume, edited by Mr. G. H. Knibbs, the Commonwealth statistician, and published at the charge of the Federal Government, contains chapters on the history of Australia, by Prof. Ernest Scott, of Melbourne; the aborigines, by Prof. Baldwin Spencer; physical and general geography, by Mr. Griffith Taylor; climate, by Mr. H. A. Hunt; vegetation, by Mr. J. H. Maiden; animal life, by Prof. W. A. Haswell; geology, by Prof. Edgeworth David, Prof. E. W. Skeats, and Messrs. T. S. Hall, W. S. Dun, and F. Chapman; astronomy and geodesy, by Mr. P. Baracchi; pastoral and agricultural development, by Mr. G. A. Sinclair; mining fields, by Mr. E. F. Pittman; manufactures, etc., by Mr. Gerald Lightfoot; education, by Prof. F. Anderson; political systems, by Prof. Harrison Moore; and miscellaneous notes, by the editor. This is in itself a very notable list, and while some of the names in it reappear among those of the contributors to the States volumes, we find also in these the names of other well-known workers in special fields, too many to detail here.

It is the purpose of the Commonwealth volume to provide a general scientific survey of Australia, while the States volumes give details each for each. While absolutely perfect co-ordination between the various volumes was scarcely to be expected, the many writers have clearly received and acted upon very precise editorial instructions as to their different fields, and duplication has been avoided as far as possible. Thus, even if the visit of the association had effected no other good, it has brought into existence a remarkable compendium of present knowledge of the continent of Australia and its resources, and a record of progress in human endeavour to make use of those resources, such as exists probably for no other country which is at a similar stage of development. These volumes, therefore, apart from their intrinsic interest and value at the moment, will become a valuable historical record. Frequently throughout them all writers are found to look forward to fields of future work, whether in the direction of pure scientific research or of economic development in which science will play a leading part.

In most of the volumes there are many excellent photographic reproductions, though the New South Wales book is less satisfactory than the rest in this respect. Particular mention may be made of a coloured plate in the Western Australia volume representing some of the wild flowers for which the State is famous. When photographic illustration is so successfully carried out, it is the more notable that the draughtsmanship and reproduction of maps is generally not so, and the valuable material which is available in the departments of geology, meteorology, and others suffers to some extent, though not always, in its representation by this means.

These handbooks were supplemented by booklets dealing with many of the excursions undertaken by members from different centres, so that the scientific interests of the visitors were provided for at almost every step, even if the guidance and verbal demonstrations given by their leaders on the spot had been less efficient than it was. The subject-matter of each State handbook is arranged under headings broadly similar to those of the Commonwealth book detailed above, with the exception of the Queensland volume, which, having been prepared, as has been seen, for a different purpose originally, deals more exclusively with historical, economic, and social topics than the others. From the point of view of the natural sciences this is unfortunate, but with such a book already in existence it was perhaps not to be expected that another should have been compiled.

It may be well to make clear that the British Association is not concerned in the issue of these books, which were compiled and issued by the Australian authorities; it is not stated whether they will be made accessible to the public.

CHEMISTRY AT THE BRITISH ASSOCIATION.

MEETINGS of the Chemistry Section were held only in Melbourne and Sydney, but in each of these cities they extended over three days. There were two joint discussions with other sections, and a number of locally contributed papers showed that in both Victoria and New South Wales a considerable amount of chemical research is being carried out, some happily on lines of special interest and value to Australia. It is to be regretted that such local features as the natural products of the characteristic Australian indigenous flora and the important problems connected with soil should not earlier have attracted local chemists, but as two sectional committees of the association are now engaged in examining the natural plant products we may hope that much will be recorded before the ever-increasing destruction of native trees and plants precludes any attempts at completeness.

MELBOURNE.

After the president's address Prof. Masson described an ingenious rearrangement of Mendeléeff's periodic table, by means of which many of the existing difficulties are removed. Instead of writing the elements in their eight groups in a two-dimensional figure throughout, Prof. Masson uses a mixture of two and three dimensions. Suppose the elements (rare earths excepted) be written in the order of their atomic weights on the inside of the covers of a book in horizontal lines, and the rare elements in their appropriate place along an uncut leaf, a fair picture of the arrangement is given. The rare earths follow each other along a horizontal series with little difference between any two members, but the end members of the series approximate to the ordinary elements found on the extreme right-hand side of the left-hand cover and the left side of the right-hand cover in the same horizontal line as the rare earths. Prof. Masson places hydrogen with the halogens, a position that is at least disputable, though by doing so the inactive gases at once form a complete series. Several properties of hydrogen and the hydrides are held to justify this position and the atomic weight of fluorine is almost the mean between those of hydrogen and chlorine.

Mr. F. H. Campbell described a method for the determination of vapour pressures the principle of which is that a liquid saturated with a suitable gas

(usually hydrogen) is allowed to evaporate into an enclosed space filled with the same gas at the same temperature and pressure. After the volume has been restored to its original value the increase in pressure is recorded on an open manometer.

A new method for determining the specific heat of liquids was described by Mr. E. G. Hartung. It consists in measuring the lowering of temperature of a known amount of the particular liquid on the introduction of a definite weight of dry ice contained in a thin glass bulb, and the method claims attention on account of its simplicity, rapidity, and accuracy, except in the case of viscous liquids like glycerine. The formation of nitric and nitrous acids in the rainfall near Melbourne has been correlated with the weather conditions by Mr. G. V. Anderson, and reveals the fact that the nitrous acid attains a maximum in winter, and a minimum in summer. It further varies with the type of weather, the total oxidised nitrogen attaining a maximum with monsoonal and a minimum with Antarctic conditions.

A joint discussion with the Physics Section on the structure of atoms and molecules has been referred to elsewhere in NATURE. It will suffice here to say that there appears to be a gulf between the views of the physicist and chemist, and little attempt made to bridge it. The former concentrates attention on the internal atomic structure, at present of only secondary importance to the chemist, while on the chemically all-important matter why atoms combine in definite ways to form molecules he has little or nothing to say.

The Melbourne programme was completed with papers by Prof. G. T. Morgan on residual affinity and co-ordination, and by Dr. A. Holt on a comparison of the phenomenon of the occlusion of hydrogen by charcoal and by palladium.

SYDNEY.

A joint discussion with the Agricultural Section on metabolism occupied one day, and was a most successful feature of the sectional programme. It was opened by Prof. H. E. Armstrong, and among the various speakers may be mentioned Mr. A. D. Hall, Mr. Darnell-Smith, Profs. B. Moore, Waller, and J. B. Wood. The discussion covered a considerable field, and for convenience may be divided into three parts. The earlier part was devoted to what may be called the formaldehyde problem and enzyme action. It cannot be said that any very definite conclusion was reached, but many interesting views were put forward, so that though the photo-synthetic processes associated with assimilation may still be said to demand further attention, great advances have been made along this line of research. Enzyme action is a fruitful field for speculation. It may be true, as suggested in the discussion, that for the metabolic synthesis of protein and fat from carbohydrates a linkage and co-ordination of an endothermic with an exothermic reaction is necessary, and that for such synthesis a colloidal regulating mechanism must be furnished by an adsorption of enzymes into the cell protoplasm, but enormous difficulties are presented to the experimental proof of such views, and when we are told that an enzyme being a colloid has its action determined by its previous history, and hence that two portions of the colloid may act differently, confusion and difficulty of proof becomes greater. This part of the discussion was full of interest, for it showed the keen attention that is being paid to those all-important subjects.

Production of fat and skin temperatures was next considered, and the conclusion was reached that though many factors come into play, fat production is associated with low skin temperatures. As the air temperature rises the skin temperature may be higher than that of the internal organs, and hence skin temperatures must not be carelessly employed as an indication that an animal is a good or bad doer, for fat production and internal temperature must also be related.

The discussion was concluded by papers dealing with cyanogenetic plants and distribution of nitrogen in seeds by Dr. J. M. Petrie. It appears that in New South Wales more than a thousand species of plants have been examined for hydrocyanic acids and cyanogenetic glucosides, sixty of them giving positive results, and of these forty-four were native to the State, and represented seventeen natural orders. Some plants which are cyanophoric in Europe do not appear to be so in Australia, whilst in others, the Australian grown plant retains its glucoside to maturity instead of losing it when half-grown. A series of specialised papers, six of which were contributed locally, were read on another day, but it is only possible here to enumerate their authors and titles. Prof. G. T. Morgan, "Non-aromatic Diazonium Salts"; Prof. Robinson, "Researches on the Synthesis of *iso*Quinoline Alkaloids"; Mrs. G. M. Robinson, "Condensation of Cotarnine and Hydrastinine with Aromatic Aldehydes"; Dr. H. McCombie, "Influence of Substituents on the Velocity of Saponification of Phenyl Benzoate"; Dr. A. Holt, "The Colouring Matters of Certain Marine Organisms"; Prof. Fawsitt, "The Corrosion of Iron and Steel by Artesian Waters in New South Wales"; Dr. G. Harker, "The Use of Waste Gases of Combustion for Fire Extinction and Fumigating Purposes"; Mr. S. Radcliff, "The Extraction of Radium from Australian Ores"; Mr. G. J. Burrows, "The Inversion of Cane Sugar by Acids in Water-Alcohol Mixtures."

An experimental lecture by Prof. H. B. Dixon on gaseous explosions and a beautiful demonstration of optical properties of crystals and liquid crystals by Prof. Pope completed the programme. Both were attended by large and appreciative audiences. In conclusion it may be said that the work of the section was in every way successful, and was almost double in amount that at an ordinary meeting in Great Britain. The audiences, too, were good, and though the Australians are so distant from their brother chemists in Europe they exhibit an interest and enthusiasm not always seen in meetings of the section at home.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The University Court has framed an Ordinance establishing the degree of B.Sc. in applied chemistry. The curriculum extends over four years, and includes nine full courses of study, of which five at least must be taken in the University or in the Royal Technical College affiliated thereto. After the usual preliminary examination, courses in mathematics, natural philosophy, and chemistry are prescribed, followed by a first science examination. Thereafter the student may pursue courses of study in advanced chemistry, inorganic, physical, and organic; technical chemistry and chemical engineering; engineering drawing; practical physics; and one of certain special branches, such as fuels, dyeing, oils, sugar, biochemistry, and technicological mycology (fermentation). Or, on the metallurgical side, he may take courses in advanced chemistry (inorganic), geology, and mineralogy; engineering and drawing; metallurgy, including fuels; electrical engineering; and one of certain special branches, such as precious metals,

non-ferrous metals, iron and steel, and alloys, and their treatment for engineering purposes. These courses are followed by a final science examination in which special distinction may be obtained in particular subjects. The degree is to be of an honours standard, and will qualify for subsequent admission to the doctorate, on the production of original work of distinction. The Ordinance will be duly submitted for the approval of his Majesty in Council. The joint resources of the chemical departments of the University and the Technical College will make it possible to provide for a complete scheme of instruction and training in preparation for the degree, which will be a valuable qualification for the chemical industries. The step taken by the University is particularly opportune in present circumstances.

DR. T. H. HAVELOCK, F.R.S., has been appointed to the recently created chair of applied mathematics and mathematical physics in Armstrong College, Newcastle-on-Tyne, in the University of Durham.

SIR ROBERT G. C. MOWBRAY, BART., Prime Warden of the Worshipful Company of Goldsmiths, will distribute the prizes at the Sir John Cass Technical Institute on the evening of Wednesday, January 13, 1915, and on the same occasion will open the new metallurgy laboratory for the mechanical testing of metals and alloys, presented to the institute by the Goldsmiths' Company.

THE annual meeting of the Mathematical Association will be held on January 9, 1915, at 2.30 p.m., at the London Day Training College, Southampton Row, London, W.C. The president, Sir George Greenhill, will give an address on mathematics in artillery science, and Dr. W. P. Milne will speak on the teaching of modern analysis, Mr. A. Lodge on circles of curvature, and Mr. R. C. Fawdry on practical work in connection with mathematics.

THE Cambridge University Calendar for the year 1914-15 has now been published. The last issue of the "Calendar" had reached unwieldy dimensions; it contained 1547 pages. The size of the present issue is 1064 pages, and this reduction has been effected in two ways, namely, by transferring some Tripos Lists to "The Historical Register," and retaining only the lists for the preceding ten years, and by treating "The Student's Handbook" as a companion volume and omitting from the calendar the information about examinations which the former book already contains.

THE annual meeting of the Geographical Association is to be held on January 7, 1915, in the Jehangier Hall, University of London, South Kensington. At the morning session, which will begin at 10.30, a lecture will be delivered by Mr. P. M. Roxby on some aspects of the geography of China, and a discussion on the value of surveying in teaching geography will be opened by Messrs. Ernest Young and J. A. White. In the afternoon at 2.30 Mr. Hilaire Belloc will give the presidential address, and afterwards a discussion on the place of map tests in examinations will be opened by Dr. J. F. Unstead and the Rev. W. J. Barton.

IN the recently published report of the United States Bureau of Education for the year ending June 30, 1913, some interesting statistics are provided relating to the 596 American institutions of higher education from which the bureau receives reports. The total sum received in gifts and bequests, excluding grants by the United States, different States, and municipalities, reported for the year was 4,930,392*l.*, showing a decrease of 26,226*l.* Of this amount 895,316*l.* was for increase of plant, 825,980*l.* for current expenses, and 3,209,096*l.* for endowment. Forty-five institutions reported gifts above 20,000*l.* Among the institutions most generously treated, the following may be mentioned: Harvard University, 419,090*l.*; Columbia University 284,361*l.*; Yale University, 283,787*l.*; University of Chicago, 261,586*l.*; University of California, 249,192*l.*; Trinity College, N.C., 240,639*l.*; and Massachusetts Institute of Technology, 214,322*l.* The income of the 596 institutions was during the year from State and municipal grants, 3,809,965*l.*; from invested funds, 3,313,962*l.*; and from fees for tuition and other educational services, 4,183,835*l.*

THE council of the London (Royal Free Hospital) School of Medicine for Women has made a public appeal for the sum of 25,000*l.* to pay for additional buildings urgently needed, and their equipment. The school was the first women's medical school in the kingdom, and since it was opened in 1874 it has been continuously successful. Of the thousand or so women now on the medical register more than six hundred are former students of the school. For its work in the past and to secure provision of sufficient numbers of medical women in the future, more lecture-rooms are essential, as well as additional laboratory accommodation and new research rooms. A site has been secured and plans have been prepared and approved, but funds are needed to pay for the buildings shortly to be commenced. It is hoped that in spite of the many demands made upon national generosity at the present time, there are yet sufficient people interested in the work and medical education of women to provide the 25,000*l.* required. Donations or promises should be sent to the London (Royal Free Hospital) School of Medicine for Women, 8 Hunter Street, W.C., addressed to the hon. treasurer, Mr. M. J. Henderson.

ALDERMAN SIR JAMES HENDERSON, of Belfast, occupied the position of chairman of the Library and Technical Instruction Committee, Belfast, from the inception of the committee until the date of his death in May of the present year, and to his memory a portrait in oils was unveiled in the Municipal Technical Institute, Belfast, on Wednesday, December 9. Sir James Henderson was identified in a very intimate manner with the remarkable progress which technical instruction has made in the city of Belfast, and the development of the corporation education scheme owed much to his unceasing efforts. The portrait was presented by the principal, staff, and students of the institute. It is to be hung in the library of the institute, where—as was said by the principal of the institute in his explanatory remarks at the ceremony—it will be a reminder not only to the present generation, but also to future generations, of teachers and students of the magnificent work that was done by the first chairman of the Technical Instruction Committee and of the splendid contribution Sir James had made to the great cause of technical instruction in Ireland. The Lord Mayor of Belfast (Councillor Crawford McCullagh), who unveiled the portrait, made reference to the many civic activities of the late chairman of the Technical Instruction Committee, adding that the Municipal Technical Institute would in itself be a lasting monument to the fine public spirit and enthusiasm of him who was depicted in the portrait. At the conclusion of the proceedings a booklet, containing a reproduction of the portrait, and also an address given by the principal at the meeting of the staff and students at which the memorial was decided upon, was distributed to the members of the audience. The portrait, which is an admirable likeness, was painted by Mr. W. G. Mackenzie.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 27.—Dr. A. Russell, vice-president, in the chair.—A. F. **Hallimond**: Note on the conduction of electricity at point contacts. The "characteristic" or volt-ampere curves given by various "point" contacts when the voltage is slowly varied are dealt with. The curves were plotted by means of a form of rocking mirror galvanometer, which projected the characteristic as the path of a spot of light on the screen, the co-ordinates being respectively proportional to the current and voltage. The first part describes the behaviour of a typical contact, zincite-tellurium. The second part describes the results obtained on examining the characteristics for the forty-five contacts possible between ten chosen substances. The results in all cases are similar to those given by zincite-tellurium. No line could be drawn separating "metallic" contacts from those in which one or both conductors were "crystals." In the third part the conclusion is drawn that in a contact yielding the unilateral (high resistance) curve, the resistance lies within the surface of the member standing higher in the series.—T. **Barratt**: Thermal conductivity of badly conducting solids. The thermal conductivities of typical solids of low thermal conductivity have been determined by the method employed by the author for pure metals and alloys. The substances tested include electrical insulators, such as glass, fused silica, and ebonite, various kinds of wood, and some partial conductors of electricity—viz., carbon and graphite. It has been shown that the thermal conductivity k is given by

$$k=\frac{\mathrm{H}^2\coth^2 al}{pqh\mathrm{V}^2},$$

or, where "l" is sufficiently great,

$$k=\frac{\mathrm{H}^2}{pqh\mathrm{V}^2},$$

Where H is the heat given to one end of the specimen, of length l, perimeter p, and cross-sectional area q; V is the difference of temperature of the "hot" end of the specimen and the enclosure; h is the heat lost from 1 sq. cm. of the surface per second when its temperature is 1° C. above that of the enclosure; and

$$a=\sqrt{\frac{hp}{qk}}.$$

In nearly every case the simpler form of the equation could be used. For the first time in the measurement of thermal conductivity a direct comparison of this quantity in the case of a non-metal has been made with that of a metal—viz., bismuth—the conductivity of which is of the same order of magnitude as those of some of the non-metals. The results agree well with those obtained by Prof. Lees's "disc" method in cases where direct comparison is available.

Geological Society, December 2.—Dr. A. Smith Woodward, president, in the chair.—Prof. T. McKenny **Hughes**: The age and character of the Shippea Hill man. A description of the skeleton, and of the circumstances in which it was found, is given. The mode of formation of the deposit in which the remains occurred is discussed. The Pleistocene deposits of the Fenland were, it is considered, laid down in a depressed river-basin behind a breached seaward barrier. Gravels of the age of *Elephas antiquus* and *Rhinoceras merckii*, as well as gravels of the age of *E. primigenius* and *R. tichorhinus*, occur within the Fenland; but they are distinguishable from the gravels which are sometimes associated with the peat and clay, and pass under them. The fauna also of the peat- and clay-deposits is quite different. In an embayed part of the Fen, close behind the island known as Shippea Hill, the skeleton was found in the peat, a few inches above the clay which is considered to be the equivalent of this Littleport Cockle Bed. When first dug out the skull was in fragments, and the calotte, with its prominent brow-ridges, suggested to many a greater affinity to the Neanderthal type, and a greater antiquity than appeared probable when the rest of the cranium was added to it.—C. **Dawson** and Dr. A. Smith **Woodward**: A bone implement from Piltdown (Sussex). Excavations have been continued in the Piltdown gravel round the edge of the area previously explored. Rolled fragments of highly mineralised teeth of Rhinoceros and Mastodon were again found, but no human remains were met with. The most important discovery was a large bone implement now described. This specimen was found in dark vegetable soil beneath the hedge which bounds the gravel-pit, not far from the spoil-heap whence the right parietal bone of the Piltdown skull was obtained two years ago. On being washed away the soil left no stain on the bone, which was covered with firmly adherent yellow clay, closely similar to that of the flint-bearing layer at the bottom of the gravel. The bone itself is highly mineralised, and agrees exactly in appearance with some small fragments of bone discovered actually in place in the clay just mentioned. There can be no doubt that the implement was found by workmen digging gravel from the adjacent hole, and thrown away with other useless débris. It is a stout and nearly straight narrow flake of bone, 41 cm. long, and varying from 9 to 10 cm. in width, with the thicker end artificially pointed, the thinner end artificially rounded. It appears to be a longitudinal strip flaked from a limb-bone by a blow at the thicker end, in the same way as flint implements were flaked from their original cores. Direct comparison suggests that it was taken from a Proboscidean femur as large as that of *Elephas meridionalis*. In microscopic structure it agrees with Proboscidean bone. The ends of the implement are shaped by cutting, and bear no marks of grinding or rubbing. Most of the cut facettes are small, and many suggest that they were made by a primitive tool, presumably a flint. The rounded end seems to have been trimmed for comfortable handling. The thick pointed (or, rather, keeled) end shows signs of battering or scratching by use. Just above the pointed end one lateral edge of the bone is marked by a large smooth groove running across from the inner to the outer face of the bone. It seems to have been originally a perforation from which the outer wall has been accidentally broken away. Within it on the inner face is the beginning of a second similar perforation, as if an attempt had been made to repair the damage. The conclusion is that the implement is unique, and no explanation of its specific use is given.

Linnean Society, December 3.—Prof. E. B. Poulton, president, in the chair.—R. C. **McLean**: An ecological journey in South America.—C. **West** and Hisayoshi **Takeda**: *Isoëtes japonica*, A. Br. *I. japonica*, A. Br., which has a fairly wide distribution in Japan, is the largest known species of this genus; according to Makino, a diameter of 8 cm. is attained by the caudex of very large specimens. The tri-lobed caudex consists of two distinct structures, viz., *stem* and *rhizophore*, to which the leaves and roots are respectively attached. But owing to the stunted growth of the plant, all external morphological differentiation between the two organs has been completely lost.

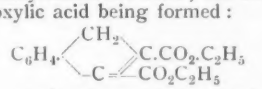
Mathematical Society, December 10.—Sir Joseph Larmor, president, in the chair.—E. H. **Neville**: Simultaneous equations, linear or functional.—Prof. W. **Burnside**: Cyclotomic quinquisection.—Prof. D. **Buchanan**: Oscillations near the isosceles triangle—solution of the three-body problem.—Prof. E. T. **Whittaker**: Larne's differential equation and ellipsoidal harmonics.

CAMBRIDGE.

Philosophical Society, November 23.—Prof. Newall, president, in the chair.—F. A. **Potts**: The colour variations of the fauna associated with crinoids. The commensals of the crinoid *Comanthus annulatum*, which is found in vast numbers on the reefs of Torres Straits, include amongst the Crustacea two species of Alpheids, three Galatheids, a Pericliimenes, an Isopod, and an Amphipod. There are also brittle-stars, a polychæt, and many Myzostomids. In most cases the commensals match the host in colour and arrangement of the markings. As the crinoid varies from very light- to dark-coloured types there is also a great variability in the commensals. In the Crustacea there is an alternation of darkly pigmented stripes with non-pigmented areas, and the relative proportions of these vary with the coloration of the host. The phenomenon is best studied in the two species of Synalpheus.—Dr. H. B. **Fantham** and Dr. Annie **Porter**: Some insect flagellates introduced into vertebrates. Insect flagellates, *e.g. Herpetomonas jaculum*, Léger, from *Nepa cinerea*, and *H. ctenocephali*, Fantham, parasitic in the dog-flea, *Ctenocephalus canis*, can live inside certain vertebrates (*e.g.* mouse and dog respectively), and can multiply therein. This the authors have shown experimentally. If such flagellates be inoculated intraperitoneally or are fed by the mouth in food, the flagellates can find their way into the blood-stream and internal organs (*e.g.* liver, spleen, bone-marrow) of the vertebrate host. The insect flagellates are pathogenic to the vertebrates experimented upon, producing symptoms like those of leishmaniasis (kala-azar). The oval, post-flagellate forms appear to be more capable of developing in vertebrate hosts than are other stages of the herpetomonad parasite of the insect. It may be expected that the various leishmaniases, occurring in different parts of the world, will prove to be insect-borne herpetomoniases.—W. R. **Thompson**: Some notes on insect parasites. These notes deal with the question of the cuticula of the Arthropods as a means of defence against parasites. An attempt was made to show that by its thickness and resistance, by the cuticular appendages such as spines and hairs, and by the process of the moult which is in strict correlation with the development of the cuticula, a very considerable part of the parasitic invasion is arrested. The heavy parasitism to which the Arthropoda are often subject was held to be due in part to the fact that many of the parasites are also Arthropods inhabiting the same environment as their hosts, in part to the structure and physiology of the Arthropods themselves, which offer as hosts an environment especially favourable to the development of parasitic organisms.—G. L. **Purser**: Preliminary notes on some problems connected with respiration in insects generally and in aquatic forms in particular. Aquatic insects were separated into two groups, true and false, according as they made use of the oxygen in the pond-water or not. Among the true group were mentioned Sialis, Gyrinus, and the Trichoptera, which have the simplest type of tracheal gill. The Ephemeridæ and Odonata were shown to have lamellate gills in which a pigment, which has been named Spadicin, is present. No explanation of its function has stood the test of facts except a respiratory one, but evidence for this is indirect only. The blood-gills of Chironomus were mentioned, and the question of the origin of a treacheal system and the problem of ecdysis of the tracheal system in true aquatic forms were discussed.—N. **Wiener**: The shortest line dividing an area in a given ratio.

PARIS.

Academy of Sciences, November 30.—M. P. Appell in the chair.—Gaston **Darboux**: The integration of a partial differential equation of the second order with two independent variables.—André **Blondel**: The calculation of the potential energy of a bobbin through which a current is flowing in the case of winding in place. A bobbin is placed in a magnetic field and a wire, carrying an electric current, is wound on this. No induced E.M.F. is produced, and several theoretical deductions based on this fact are given.—E. **Colardeau**: Method for the exact localisation of projectiles in wounded persons by the radiographic method. The method detailed permits the exact localisation of the projectile within five minutes of the measurement of the photographic plates.—Victoriano F. **Ascarza**: The total eclipse of the sun of August 21, 1914, observed by the Spanish expedition at Theodosia (Crimea). Observations were possible of the second and third contacts and the total phase, but clouds somewhat interfered with the work. Photographs were taken with two spectrographs, one fitted with a Rowland grating, the other with a prism, special attention being given to the infra-red region (see p. 432).—P. **Carrasco**: Physical observations made at Theodosia during the total eclipse of the sun of August 21, 1914.—M. **Fournier**: General conditions of aptitude at high velocities of a hull in navigation.—J. **Rougault**: Indene-dicarboxylic and hydrindenedicarboxylic acids. A study of the condensation of benzyloxalacetic ester with sulphuric acid. The reaction is not analogous with the condensation of the lower homologue, phenyloxalacetic ester; the ester of a new indene-dicarboxylic acid being formed:



Proofs of this constitution are given.—René **Régamey**: Cancer in plants. Proofs are given of the existence in plants of a cancerous disease differing from Smith's crown gall, spontaneous in the oak, and inoculable into other plants. It is produced by a bacterium capable of isolation and cultivation in artificial culture media. The parasite is intracellular in the tumours.—P. **Carnot** and B. **Weill-Hallé**: Biliculture in typhoid fever. Two alternative methods of obtaining bile from the patient are described. The cultivation of the typhoid bacilli present in the bile is easy, pure cultures being readily obtainable. The course of the disease can be followed, and the method is especially valuable in tracing the persistence of infection in convalescents and typhoid carriers.—Paul **Godin**: a premonitory sign of pulmonary tuberculosis.—F. **Bordas** and M. **Brocq**: Water supply to armies in the field. It is accepted as fundamental that all water drunk should be previously boiled, and the most practical way of ensuring this is to insist that weak tea should be the ordinary drink. For an army of 1,000,000 men, drinking one litre every twenty-four hours, this implies a daily consumption of 15,000 kilograms of tea. The problems of making and distributing the tea at the front are discussed. The same boilers can supply not only water for drinking but warm and sterilised water for the treatment of the wounded.—L. G. **Seurat**: Precocious copulation in Oxyuris.—A. **Sartory** and Ph. **Lasseur**: Contribution to the study of a new pathogenic Oospora (*Oospora bronchialis*). This new organism was isolated from a case in which the most prominent

symptom was foul-smelling breath and putrid expectoration. The fungus was shown to be pathogenic to the guinea-pig and rabbit, producing bilateral purulent pleurisy. Treatment with potassium iodide caused marked improvement.—F. **Kerforne**: The systematic position of the deposits of iron ore in the lower Ordovician in the region of Châteaubriant.

BOOKS RECEIVED.

South Australia. A Review of Mining Operations in the State of South Australia during the Half-Year ended June 30, 1914. Pp. 64. (Adelaide: R. E. G. Rogers.)

Department of Mines. Geological Survey of N.S.W. The Great Australian Artesian Basin and the Source of its Water. By E. F. Pittman. Pp. 57. (Sydney: W. A. Gullick.)

Transactions of the Paisley Naturalists' Society. Edited by Rev. C. A. Hall. Vol. ii. Pp. xvi+120. (Paisley: A. Gardner.) 3*s.* 6*d.* net.

Intermediate Practical Chemistry for University Students. By F. W. Atack. Pp. viii+204. (London and Manchester: Sherratt and Hughes.) 4*s.* net.

The Elements of Electro-Plating. By J. T. Sprague. Pp. vii+72. (London: E. and F. N. Spon, Ltd.) 1*s.* 6*d.* net.

Liquid Drops and Globules: their Formation and Movements. By C. R. Darling. Pp. x+83. (London: E. and F. N. Spon, Ltd.) 2*s.* 6*d.* net.

The Dynamics of Surfaces: an Introduction to the Study of Biological Surface Phenomena. By Prof. L. Michaelis. Translated by W H. Perkins. Pp. viii+118. (London: E. and F. N. Spon, Ltd.) 4*s.* net.

Motion of Liquids. By Lieut.-Col. R. de Villamil. Pp. xiv+210. (London: E. and F. N. Spon, Ltd.) 7*s.* 6*d.* net.

An Introduction to the Study of Fossils (Plants and Animals). By Prof. H. W. Shimer. Pp. xiv+450. (London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

Iowa Geological Survey. Vol. xxiv. Annual Report, 1913, with accompanying Papers. Pp. xvi+792. (Des Moines: Iowa Geological Survey.)

The Cambridge University Calendar for the Year 1914–15. Pp. xxx+1034. (Cambridge University Press.) 7*s.* 6*d.* net.

Department of the Interior. U.S. Geological Survey. Mineral Resources of the United States. Calendar Year, 1912. Part i., Metals. Pp. 1079. Part ii., Non-Metals. Pp. 1218. (Washington: Government Printing Office.)

Plane Trigonometry and Tables. By G. Wentworth and D. E. Smith. Pp. v+188+v+104. (Boston and London: Ginn and Co.) 5*s.*

Elements of General Science. By Dr. O. W. Caldwell and W. L. Eikenberry. Pp. xiv+308. (Boston and London: Ginn and Co.) 4*s.* 6*d.*

Bergens Museum. Aarsberetning for 1913 og iste halvaar 1914. Pp. 122. Aarbok 1914–15. 1ste Hefte. Avhandlinger og Aarsberetning utgit av Bergens Museum. By J. Holmboe. Skrifter. Ny Roekke. Bind i., No. 2. Studies on the Vegetation of Cyprus. By J. Holmboe. Pp. 344. (Bergen: J. Griegs.)

An Account of the Crustacea of Norway. By G. O. Sars. Vol. vi., Copepoda Cyclopoida. Parts v. and vi., Cyclopidæ. Pp. 57–80. (Bergen: Museum.)

Elements of Forestry. By Profs. F. F. Moon and N. C. Brown. Pp. xvii+392. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 8*s.* 6*d.* net.

American Handbook for Electrical Engineers. H. Pender, Editor-in-Chief. Pp. xviii+2023. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 21*s.* net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 17.

ROYAL SOCIETY OF ARTS, at 4.30.—The Indigo Industry: Dr. F. Mollwo Perkin.

INSTITUTION OF MINING AND METALLURGY, at 8.—*Adjourned Discussion*: Persistence of Ore in Depth: T. A. Rickard.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 8.—Notes on the Development of the Trinidad Oilfields: Prof. J. Cadman.

LINNEAN SOCIETY, at 8.—"Witches Brooms," caused by the Gall-mite, *Eriophyes triradiatus*, Nal., on *Salix fragilis*, illustrated by lantern-slides: M. Christy.—The Brent Valley Bird Sanctuary; An Experiment in Bird Protection: W. M. Webb.

FRIDAY, DECEMBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Audible and Other Cab Signals on British Railways: W. C. Acfield, L. P. Lewis, V. L. Raven, W. A. Stanier, and W. Willox.

WIRELESS SOCIETY, at 8.—The High Frequency Resistance of Wires and Coils: Prof. G. W. Osborn Howe.

PHYSICAL SOCIETY, at 5.—Exhibition and Description of Some Apparatus for Class Work in Practical Physics: Dr. G. F. C. Searle.—A Vacuum Guard Ring and its Application to the Determination of the Thermal Conductivity of Mercury: H. R. Nettleton.

MONDAY, DECEMBER 21.

INSTITUTE OF ACTUARIES, at 5.—Canadian Mortgages Regarded as a Field for the Investment of the Funds of British Life Assurance Companies, with some General Notes on Canadian Indebtedness: A. D. Besant.

CONTENTS.

	PAGE
The Royal Society of Arts. By **A. A. Campbell Swinton**	415
Household Science. By **A. S.**	416
Hog-Spears and Fishing-Rods. By **R. L.**	416
Mathematical Text-Books	417
By-Ways of Medicine. By **Prof. R. T. Hewlett**	418
Our Bookshelf	419
Letters to the Editor:—	
Wet Bulb Temperature and Climatology.—**Prof. Leonard Hill, F.R.S., Martin Flack, O. W. Griffith**	419
Forests and Floods.—**Dr. John Aitken, F.R.S.**	420
On an Apparently Distinctive Character of the Genus Bufo.—**Geo. E. Nicholls**	420
A Lunar Halo.—**Thos. Todd**	421
Colloidal Chemistry in Relation to Industries.—I. By **E. Hatschek**	421
"Field-Work" with the British Association in Australia. (*Illustrated.*) By **W. A. H.**	423
The Health of the Expeditionary Force. By **Stephen Paget**	425
Thinking Animals. By **C. S.**	426
The Rev. Sir John Twisden. By **Sir G. Greenhill, F.R.S.**	427
Notes	427
Our Astronomical Column:—	
Comet 1913*f* (Delavan)	432
The Spanish Solar Eclipse Expedition	432
The Recent Transit of Mercury	432
Atmospheric Pollution. (*Illustrated.*)	433
The Natural History of an American Desert Basin. (*Illustrated.*) By **F. C.**	434
Finishing Temperatures of Rail Steel	436
Forest Entomology	436
Australian Handbooks for the British Association	436
Chemistry at the British Association	437
University and Educational Intelligence	438
Societies and Academies	440
Books Received	442
Diary of Societies	442

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.